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NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Other communications relating to advertisements or general matters should be addressed to the Manager.

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Chemical Engineering

THE Chemical Engineering Group of the Society of Chemical Industry may be congratulated on the excellent programme which has been arranged for the third conference on Friday next at Birmingham. The general subject for discussion—a particularly important one in view of the growing cost and difficulties of labour—is "Labour-saving Devices in Chemical Works," and it will be dealt with in the following seven Papers: "Modern High-speed Electric Telpherage and its Applications in Chemical Works," by H. Blyth; "Pneumatic Conveying of Coal and Similar Substances," by H. J. H. King; "Some Notes on Portable Conveyors and Transporting Trucks," by Captain C. J. Goodwin; "Pneumatic Conveying of

Granular Substances, including Chemicals," by Gordon S. Layton; "The Development and Use of Labour-saving Devices in the American Chemical Industry," by A. E. Marshall; "The Importance of the Mechanical Handling of Material and Its Relation to Production Costs," by H. Varndell; "Automatic Filling Machines for Liquids," by H. F. Broadhurst. Outside the conference programme there will be an informal dinner at the Grand Hotel on Friday evening, and a visit to some of the works of the B.S.A. Co., Small Heath, on Saturday morning.

The programme of the Birmingham Conference is in itself worth a note on account of the obvious care with which it has been designed and the ambition to avoid the conventional. When the modernist spirit takes possession of a movement there is always a little danger of its being overdone; but the authors of the programme have just managed to avoid the sense of straining after some new effect, and their attempt at a really interesting and stimulating booklet is quite a success. In the propagandist chapter at the end considerably more attention is given to the Society of Chemical Industry than to the Group itself—from which one may conclude that there is no foundation for any doubt as to the loyalty of the Group to the parent body.

The business of the Group, as those familiar with its work already know, and as the uninformed will learn on reading the programme, is primarily with the productive and economic sides of chemical industry—the design, erection and working of plant for the translation of the processes of the laboratory to the competitive field of commercial production. "The study of such problems and the development of methods for their solution," it is stated, "has not at all, until lately, received systematic attention in this country, although dealt with in the U.S.A. and on the continent for over thirty years, and it is not more than three or four years ago since chemical engineers with foreign training and experience were called in to assist the Government of this country at a time of national crisis. The significance of this lies in the fact that there were in the country at the time both chemists and engineers who were unable jointly and severally to overcome the difficulties to be faced, and that the trained chemical engineer was required in order to do this. The business of the Chemical Engineering Group is, therefore, to encourage the study of chemical engineering and familiarise manufacturers with its methods by holding conferences on important problems of general interest. Among those to be dealt with are the following: Utilisation of Waste, Smoke Abatement, Water Supply and Treatment, Filtration, Materials of Construction, Chemical Works Organisation and Accounts, Refrigera-

tion, Gas Cleaning, Crystallisation, Pressure Plant, Pulverised Fuel. The Group is particularly engaged in collecting numerical expressions of the results of general chemical engineering experience, and publishing these in the form of tables or data for use in the design or working of plant. The Group gives its members, on request, information regarding supplies and suppliers of chemical plant and apparatus, and keeps in touch with the latest developments of chemical engineering enterprise at home and abroad."

The Oil Position in America

THOSE who take the trouble to read all that the prophets have to say about the future of the oil industry will probably have appreciated by now that the whole question is largely one of speculation. Certainly, there is some consistency of opinion among those who have a technical knowledge of the subject; but the facts given by the financial experts appear to contradict one another at every turn. Sir E. Mackay Edgar has recently been giving his views on the subject, and predicts that in a few years' time America will be compelled to import immense quantities of oil, the payment for which will find its way largely into British pockets. This state of affairs is likely to result, it seems, from the fact that America has been exhausting her supplies at a prodigious speed, while this country has been getting an ever firmer grip on the world's reserves of oil. Careful estimates have indicated that there is only enough oil in America to last for another twenty-two years, and certainly the latest published figures show that she is becoming increasingly dependent upon imports of the crude product. According to the *Board of Trade Journal*, the United States production has increased from 266 million barrels in 1914 to 350 million barrels in 1918. On the other hand, imports—chiefly from Mexico—have grown steadily, reaching a total of nearly 2,000 million gallons in 1919, against some 800 million gallons in 1914. The use of oil for ship propulsion is, moreover, growing enormously, and it has been estimated that 250 million gallons will be required in America for this purpose alone during the current year.

Sir E. Mackay Edgar says that the controlling factors in the way of oil in America are transport and finance. The exhaustion of the old fields means scrapping the plant laid down to connect with them; and transport charges are so heavy that it is cheaper to put down new plant, even at the sky-high prices of to-day, than to move the old pipe-lines and refineries to freshly-opened fields. The great American oilfields of the present lie in the west, but the consuming centres are still mainly in the east. Transport, therefore, is a problem that every year becomes more and more crucial.

The world has been diligently scoured for new oilfields; but, apart from Mexico, America has obtained control in practically none of the new areas. All the known and probable oil areas outside the United States are mainly in British hands in one way or another, and it certainly seems most probable that in a few years' time America will have to purchase from British companies to the tune of many million pounds per annum.

Chemical Bank Amalgamation

THE recent announcement in the financial press of the amalgamation of the Chemical National Bank of New York with the Citizens' National Bank may have set some readers speculating as to this curious association of chemical and financial interests. The story is worth recalling. The Chemical National Bank was established in 1824 as the New York Chemical Manufacturing Co. under a charter which provided that the company could receive deposits. The authorised capital was 500,000 dollars, and it was stipulated that 100,000 dollars must be employed in the manufacture of chemicals. The charter was for 20 years, and when it expired in 1844 it was decided to liquidate the old manufacturing company, although it had been an entirely successful venture. The company returned to the shareholders the amount of their original investment, plus 50 dollars per share. Among the products manufactured were blue vitriol, alum, aquafortis, nitric acid, muriatic acid, alcohol, tartar emetic, refined camphor, saltpetre, borax, copperas, corrosive sublimate, calomel and various medicines, paints and dyes' colours.

With the liquidation of the chemical manufacturing company the Chemical National Bank was formed. Many of the former shareholders and some new ones subscribed the capital stock of 300,000 dollars, and this sum was all that was ever paid into the bank by the shareholders. Starting with this investment of 300,000 dollars the bank has earned 2,700,000 dollars, and has given to shareholders an accumulated surplus of 10,000,000 dollars. It has, in addition, distributed among the shareholders dividends exceeding 16,000,000 dollars. In the amalgamation with the Citizens' National Bank, a younger institution by some years, the name of the older corporation will still be retained. The consolidated bank will begin operations about May 1 under the old name of the Chemical National Bank of New York, and its enlarged financial resources will give it the seventh place among the banks of New York City. Mr. Percy H. Johnson, president of the Chemical National Bank, and Mr. H. K. Twitchell, chairman of the board, will hold the corresponding positions on the staff of the consolidated bank.

The Dangers of Benzol

WE recently referred in these columns to some unfortunate experiences with benzol which had been met with in Germany. We pointed out at the time that we had no record of any cases of asphyxiation from benzol fumes in this country, although a correspondent sent us, later, some particulars of instances of the kind which he had come in contact with. It would seem that our warning was none too early, for we note that a benzol fatality has just occurred at Putney. A man was cleaning out a benzol storage tank belonging to the Anglo-American Oil Company, when he was asphyxiated and died shortly afterwards. The virulent nature of the atmosphere inside the tank may be gathered from the fact that a fellow workman who attempted rescue was himself overcome, and fell to the bottom of the tank, being saved only with great difficulty by means of a rope and hook.

The experience should certainly provide an object-lesson for those who deal with benzol storage in bulk,

and some recognised method of working should be followed when tanks of the kind have to be cleaned. It would seem that one safeguard would be to provide manhole covers at the bottom of the tank as well as at the top, so that a current of air would pass directly through, and rescue would, if the question of it arose, be made very much easier. In order to relieve the minds of those who consume benzol in small quantities, such as for motoring, it should be made quite clear that it only exhibits the above-named dangers when met with in a confined space such as a tank.

A Sonnet on "Hexahydrobenzene"

WE have from time to time acknowledged the kindly references made to THE CHEMICAL AGE in so many quarters, and the extent to which its pages are quoted from, not only in the British, but almost equally in the American and Continental technical press. Up to this week, however, we had not been guilty—at least knowingly and with intent—of inspiring a poet to break into song. This proud distinction has now been attained, and we should be more or less than human to refrain from recording it. One of the unexpected by-products of our Editorial Note on April 10 on "Hexahydrobenzene as a Fuel" was the publication in the *Daily Chronicle* of Friday last of the following verses:—

AERO-POETRY.

[Inspired by an article in "The Chemical Age."]

Benzene, as every schoolboy knows,
By mere hydrogenation,
In streams of cyclohexane flows,
A chemic transmutation.

With nickel as the catalyst—
'Tis highly calorific—
A hexahydrobenzene twist
Is given that specific.

Yet, reader, would you dwell at ease
With substances so spillable,
Of hexahydrobenzene, please
Breathe not another syllable.

A. W.

The Corrosion of Iron

THE time-honoured problem of the corrosion of iron and steel has recently been receiving renewed attention in America, and some interesting views have been expressed in connection with the fundamental reactions which are responsible for corrosion. The subject has mainly been dealt with from the point of view of pipes carrying either steam or hot water, and the major source of the trouble has been traced to the dissolved gases brought into the system. Both cast iron and steel are, apparently, sensitive to the action of hot water, and it has been well established that the factors which cause corrosion—rather than the characteristics in composition of the metal—determine the rate of corrosion. Speller and Knowland have recently pointed out that water is found in two varieties, which may be distinguished as active and inactive. The quality of activity is not primarily dependent upon the acid, alkaline or neutral condition of the water; but rather upon certain dissolved substances which influence the capabilities of even the purest water to initiate the corrosion process. All experimental evidence goes to show that dissolved oxygen in water is the key to

the vast majority of corrosion cases, and that if oxygen can be eliminated, with the effect of rendering the water "inactive," then corrosion in pipes, tanks, boilers, &c., may be practically overcome. The important point to be kept in mind is that corrosion is purely a matter of electrolytic activity, and that the presence of oxygen in water in no sense *causes* corrosion, but aids in its unimpeded operation.

The Calendar

April 24	Royal Institution of Great Britain: "The Thermionic Vacuum Tube as Detector, Amplifier and Generator of Electrical Oscillations" (Second Lecture), Dr. W. H. Eccles. 3 p.m.	21, Albemarle Street, London.
26	Royal Society of Arts: "Aluminium and its Alloys." Dr. W. Rosenhain 8 p.m.	John Street, Adelphi, London.
27	Sheffield Association of Metallurgists and Metallurgical Chemists: "The Non-Metallic Inclusions in Steel." F. Rogers.	Sheffield.
28	Royal Society of Arts: "Ancient Stained Glass." Brig.-Gen. C. H. Sherrill. 4.30 p.m.	John Street, Adelphi, London.
28	National Union of Scientific Workers: "The Public Support of Scientific Research." Professor Frederick Soddy. 8 p.m.	Birkbeck College, Bream's Buildings, Chancery Lane, London, E.C.
28-29	Ceramic Society: Seventh Meeting of Refractory Materials Section. Council Meeting, various Papers and Dinner.	Stoke-on-Trent.
29	Association of Engineering and Shipbuilding Draughtsmen, Chesterfield Sub-Branch (Technical Section): "Gas Producer Plant." John J. Nicholson. 7.30 p.m.	Grammar School, Chesterfield.
29	West of Scotland Iron & Steel Institute Annual Meeting: "Casting of Steel Ingots." S. W. Williamson. 5 p.m.	Chemical Society.
29	Institution of Mechanical Engineers: Discussion on Papers.	Engineers' Club, Manchester.
29	Royal Society. 4.30 p.m.	Burlington House, Piccadilly, London.
30	Manchester Literary and Philosophical Society: Annual Meeting of the Chemical Section. 6.30 p.m.	—
May 1	Royal Institution of Great Britain: Annual Meeting of Members, 5 p.m.	21, Albemarle Street, London, W.1.
3	Society of Chemical Industry (London Section): Annual Meeting.	Rooms of the Chemical Society, Burlington House, Piccadilly, London, W.1.
5	Society of Arts: "A Photographic Research Laboratory." Dr. C. E. Kenneth Mees. 4.30 p.m.	John Street, Adelphi, London.
5	Society of Public Analysts: Papers by C. A. Mitchell, E. R. Dovey, H. Droop Richmond and Edith M. Ison	Rooms of the Chemical Society, Burlington House, Piccadilly, London, W.1.
6	Chemical Society: Ordinary Scientific Meetings. 8 p.m.	Burlington House, Piccadilly, London W.1.
6-7	Iron & Steel Institute: Annual Meeting and Annual Dinner.	Great George Street, Westminster.
7	Society of Chemical Industry: "Azo Dyes from Alpha-Naphthylamine and its Products." F. M. Rowe.	College of Technology, Manchester.

Fire Dangers in Factories and their Causes.—I

By T. H. Gant, A.R.C.S.(Lond.), A.I.C.

The experience of the author as Danger Building Officer at H.M. Factory, Gretna, gives exceptional weight to this article, which will be continued and completed in subsequent issues. While the conditions at such great works as Gretna, especially during the progress of the war, are not normal, the study of the whole problem of fire dangers is of general application to practically all works involving the employment of chemical processes and materials. Mr. Gant's notes on the subject were originally communicated to the Scientific Society of H.M. Factory at Gretna, and the numerous applications for copies suggest that their publication in complete form will be widely appreciated.

FIRE may be described as the visible form of combustion, and what is understood chemically by combustion is the process whereby substances or their individual constituents combine with oxygen with the liberation of heat. In order to bring about this process, three factors are necessary—the substances to be consumed, oxygen to support the combustion, and heat. Heat must be supplied in order to raise the substance to be consumed to a certain temperature before it can burn, when this temperature is attained the substance furnishes inflammable vapour; this temperature is known as the "flashing point" of the substance, but even then the substance as a whole may not have reached the stage of continuous combustion or burning point. This can be illustrated by heating a substance like petroleum to a temperature of 76 C., at which it will flash, but will not burn until a higher temperature has been reached. The burning point is the temperature at which the body is capable of igniting and burning.

While the flashing point of any one substance is fairly constant, the burning point may, in practice, fluctuate considerably depending on the chemical purity of the substance. The burning point is generally higher than the flashing point, although occasionally they may coincide, as in the case of ether, benzene and alcohol.

Causes of Fire

The following table gives eight principal causes of outbreak of fire or explosion:—

- (1) Direct ignition by flame or glowing material.
- (2) Spontaneous heating.
- (3) Spontaneous ignition.
- (4) Explosion.
- (5) Electric sparks, flashes of lightning.
- (6) Chemical reaction.
- (7) Pressure, friction, shock, concussion.
- (8) Focussed rays.

Supplementary to any one of these causes must be the presence of warmth and air, or oxygen. We are exposed to all these risks on the factory.

With the dangers of direct ignition, you are familiar and they are guarded against by rules governing the control of fires, lights, &c. As regards spontaneous heating, this is frequently the forerunner of spontaneous ignition. This may be illustrated by placing some volatile liquid, such as ammonia, in a flask in which is suspended a thermometer, round the bulb of which is wrapped some cotton-wool. The temperature registered will at once begin to rise, and will quickly go from 10°C. to 16°C. or over. This phenomenon is due to the condensation of the ammonia vapour on the fibres of the cotton-wool.

The condensation of gases or vapours on a porous fibrous substance is always accompanied by the liberation of heat. Under favourable conditions, such accessions of temperature often proceed to such an extent as ultimately to lead to spontaneous ignition, i.e., the substance may take fire of its own accord and this sometimes explosively.

In the case of spontaneous ignition this may be said to be due to quick or slow oxidation or combustion due to chemical, electrical, biological or such physical processes as those of vibration, pressure, shock or friction, but

without the conjoint assistance of extraneous sources of heat as flame.

Of the substances which we handle on the Factory apart from actual explosives, certain are known to be prone to this form of ignition, viz. :—

Cotton waste bales, fly, or other fibrous materials, such as jute nitre bags impregnated by oxidisable oils or fats or oxygenating substances such as nitrate of soda.

Coal, charcoal, wood, sawdust, corkdust, insulating materials, varnishes, lacquers, oils, dryers, fats, disinfecting powders, carbides, polishing rags and clothing in a greasy and dusty condition.

Ether.

Conditions of Spontaneous Ignition

The following are the conditions which may produce spontaneous ignition in any of those substances :—

1. Coal.—Storage in large heaps, the occlusion of oxygen and the subsequent oxidation of resinous substances and contained sulphur.
2. Wood, Organic Substances.—Protracted drying.
3. Lampblack.—Oxidation of contained sulphur, recent calcination.
4. Fibrous Materials.—Oxidation of contained fat or oil.
5. Quicklime, Carbides.—Absorption of moisture.
6. Readily ignitable substances generally.—Concentration of sun's rays.
7. Detonating or other explosive substances.—Friction, pressure, shock, concussion.

8. Explosive Vapours, such as mixtures of either Ether, Acetone, Alcohol or Acetylene and Air.—Electricity sparks.

The first four of these, namely, coal, wood, lampblack and fibrous materials, give rise to spontaneous ignition by slow development of heat which may extend over a period of two or three months, and generally occurs where the substances are stored in bulk. The next two—quicklime and carbides and readily ignitable substances—undergo spontaneous ignition. Substances in the remaining two sections are explosive.

Beams of timber will ignite spontaneously under prolonged exposure to moderate warmth, even below 100 C., but not until all the moisture has been driven off. This done, a warmer current of air will fire the wood.

Many fires are traceable to the insidious action of the sun. The chief contributory factors towards an outbreak of fire from this cause are as follows :—

1.—The sun's rays focussed to a point through a lens are by reason of their intense heat able to carbonise and ignite organic substances in a very short time. For this purpose lenses may be replaced by any glass articles, e.g., glass bottles, glass balls or bulbs, glass vessels, tiles or window panes containing air bubbles in which the air bubble acts as a lens and so focusses the rays.

2.—When water containing only small amounts of explosive substances is evaporated, the residual explosive will explode by the slightest insolation.

3.—Glass vessels containing dangerous liquids, such as benzene, ether or carbon disulphide may burst on prolonged insolation, the escaping liquid becoming ignited in contact with any adjacent flame.

4.—The prolonged exposure of ether to the sun leads.

to the formation of vinyl alcohol which may cause spontaneous explosions on the evaporation of the ether.

5.—Barrels filled with tar which still contain some of the more volatile products from gas making can be exploded by sun heat.

6.—The solar rays also assist spontaneous heating and ignition by retarding superficial cooling and, moreover, exert a heating effect on the substances themselves.

Machinery Explosions

We sometimes meet with explosions which are solely due to physical phenomena, such as weakness or defects in the construction or subsequent distortion of container vessels or machinery. The chief danger attached to machinery explosions is the fact that flying parts are liable to strike and burst vessels containing dangerous liquids, and so give rise to disastrous fires or explosions. Repaired fly-wheels and centrifugal machines are cases in point, especially where the latter are unevenly loaded. Fly-wheels rotating in a line with plant liable to risk of fire or explosion are always a possible course of danger. Fly-wheels have been known to burst when running at normal speed. Prolonged use, say up to 30 years, with very slight distortion of the individual parts of the wheel caused by the constant reciprocal reaction between the rim and spokes or other displacements are liable to cause disruption of the wheel.

Explosions in Container Vessels

Explosions frequently occur in tanks which have held inflammable liquids. These are mainly due to the removal of the bung in such a way as to cause sparks, or by bringing a flame near them, and so igniting the explosive vapour in the vessels before they have been thoroughly washed out. Several such explosions have occurred. Lead-lined eggs frequently blister inside owing to acid passing through defective parts of the lining with the result that hydrogen or oxyhydrogen gas is formed underneath the lead. In repairing the blistered linings care should be taken not to strike the blistered part or to take a flame into the tank before it has been thoroughly cleaned out. Many fatal accidents have been caused by neglecting to do this. Blistering of lead sometimes makes itself manifest near the windows inside the necks of nitrator separators, used for Nitro-Glycerine. Calcium sulphate is formed between the two surfaces of lead, forces them apart, and so gives rise to all sorts of serious possibilities.

Explosions, closely akin to dust explosions, are liable to occur in air receivers. These may be due to the large amount of oil which is in suspension. Imagine an air receiver, exposed to the sun, containing some oily cotton waste which has been used for cleaning purposes; should the waste undergo spontaneous ignition as it is liable to do, an explosion could easily occur. These conditions would be rendered more dangerous by the presence of a substance like petrol vapour, which was once recommended for cleaning out a tank on this Factory. I also heard of a case where a bag full of oily cotton waste was found in such a tank.

Carboys and tanks used for the storage of acids are liable to explode. This is due to the liberation of vapours from such acids as HNO_3 , HCl , or mixtures of nitric and sulphuric acids, as the result of warm storage on the exposure of the tanks to the sun's rays. Violent explosions have been known to occur in the strongest iron tanks due to exposure of the tanks to the sun for a few hours. It is for this reason that such tanks are roofed in on this Factory. Hydrogen gas is also formed if weak acid be allowed to stand in iron tanks or by the action of the acid on rusted parts of the tanks. It is obvious that where this is the case, it would be dangerous to take a light near the vessels.

The storage of liquid ammonia is not unattended with a certain amount of risk when one considers that the pressure

in storage cylinders rises from 4.4 atmos. at zero to 10 atmos. at 28°C .

Dust Explosions

Amongst the different types of explosions to which we are subject is that of the dust explosion. Inasmuch as the majority of gases or vapours are merely inflammable, it is an essential condition that a certain proportion of oxygen be present in the case of a gas explosion. Should a gas or vapour contain any dust in suspension the dust will take the place of air or oxygen and the whole becomes explosive. The dust first burns and then explodes. Many substances which only burn with difficulty when in a compact state will burn with the greatest ease when in a finely divided condition.

Dust in a finely comminuted condition presents an extremely large superficial area and offers a great surface attraction for oxygen or other gases which may be present. The dust particles thus form a highly inflammable material which in presence of a flame will ignite with ease. In the case of dust from fibrous material, such as cotton waste, it first burns with the formation of carbon monoxide, which then combines explosively with a further quantity of oxygen forming carbon dioxide. In this case, the explosion is seen to occur in two stages, but owing to the extreme rapidity with which it takes place, it forms practically one operation.

Dust explosions are always violent in character, the comparative violence of which can be illustrated by taking a small quantity of mercury fulminate and exploding it by ordinary means in a room. The explosion will be found to be quite local in character, and will do no great damage. But take a similar quantity of fulminate and spread it out evenly on a table and then drop a weight on the table in such a way as will cause the dust to rise and disperse itself about the room. On sparking the mixture a severe explosion will take place, completely wrecking the room.

Dust explosions have been known to take place with the undermentioned substances:—Carbon, wood, dust, cork, wool, fibres, textiles, tow, fluff, fly, sulphur, naphthalene.

The violence of a dust explosion is considerably increased by a preliminary heating, or by violent and sudden motion of the dust. Curiously enough, most dust explosions have occurred at the moment of opening a machine, or at the commencement of work, but on the other hand, shock, percussion or friction unaccompanied by the production of flame will not cause dust explosions.

How Dust Clouds are Formed

The following table shows the various ways in which dust clouds are formed:—

Method.	Substance.
(1) By combustion of the materials...	Lampblack.
(2) By dry distillation, sublimation, unloading of trucks	Sulphur.
(3) Grinding and pulverising	Pyrites.
(4) Extracting dust, fly, from fibrous materials	Cotton waste.
(5) Dropping and bursting of bags containing dusty materials	Lampblack carbon.

Nos. 1 and 2 are the least dangerous as the dust is formed slowly under ordinary working conditions. No. 5 may be considered to be the most dangerous as the formation of dust is so sudden, for the more rapidly and violently the dust is formed, and the finer the state of division, the greater the danger becomes.

The formation of dust is always accompanied by the liberation of heat, but it is not sufficient to raise the material to its point of ignition unless the dust is produced in a closed vessel and the dissipation of heat is prevented, in which case the temperature of ignition of the material determines whether or not the accumulated heat will result in an explosion.

The influence of dust on the explosibility of a gas mixture is well illustrated in the case of coal-gas and air by the following table :—

Mixture Coal Gas. Per cent. Composition.	Effect.	Addition of Lampblack.	Effect.
3 per cent.	Does not burn.	Addition of little lamp-black.	Burns with audible noise.
8-12 per cent.	Burns with a noise but will not explode.	" "	Explodes.
12-23 per cent.	Explodes.	" "	Explodes more violently.

Explosives

The risks attaching to the explosives as manufactured on this Factory are all dealt with in the Factory Special Rules, but as I am sometimes asked for the decomposition temperatures of the various explosives, I have prepared the following table :—

Temperature.	Explosive.	Effect.
13°C.	Nitroglycerine.	Freezes.
100°C.	"	Vaporises with difficulty.
185°C.	"	It boils.
241°C.	"	It detonates.
257°C.	"	Explodes with great violence. Temperature rises to 698°C.
267°C.	"	Explodes faintly.
287°C.	"	Explodes very faintly with production of flame.

Nitroglycerine

Nitroglycerine is more dangerous in the frozen than in the liquid condition, as the hard crystals become strongly heated by mutual friction; when thawed suddenly, it explodes without exception. Nitroglycerine explodes with great violence under concussion or a blow, and its sensibility is increased by a neighbouring explosion. It ignites with difficulty and in small quantities burns without exploding. I once led a strand of burning Mark I. Cordite into some nitroglycerine. The nitroglycerine extinguished the cordite, thus demonstrating the difficulty of ignition. If nitroglycerine is poured on to glowing iron it ignites without exploding, but on the other hand, if the iron is only warm enough to raise the temperature of the nitroglycerine to 241°C. it explodes because it is caused to boil. If subjected to repeated warming and cooling it will decompose at as low a temperature as 30°C., otherwise incipient decomposition does not ensue below 70°C.

An erroneous idea seems to exist in the minds of some people that nitroglycerine in solution with alcohol is killed or rendered harmless. I was recently asked to explain this, but I could only reply that nitroglycerine in solution with methyl alcohol is said to be more sensitive to concussion than the pure substance.

Explosive—Nitrocotton (Hexamitrate).

Ignition point	= 160°C.
Explosion point	= 137-139°C.
Explosion point (air dry)	= 185°C.
Explosion point (compressed)	= 201°C.

Collodion Nitrocotton (Tetranitrate).

Ignition point	= 150-160°C.
Explosion point	= 186-199°C.

Wet and Dry Nitrocotton

Wet nitrocotton cannot be exploded by the action of flame, shock or blows, but is highly explosive when under the influence of ignited mercury fulminate, nitroglycerine or dry nitrocotton.

Dry nitrocotton is exceedingly inflammable and it electrifies very easily. It has been known to spark when rubbed with hands and so cause explosions. An instance of this kind occurred at the New Explosives Company at Stowmarket, a few years ago, when four men engaged in the manufacture of cordite were killed. Two of the men, who bore excellent characters for steadiness and reliability were on the point of handing out to two truckers bags of cordite paste for removal to the Paste Mixing House. They wiped down the bags with their hands in order to get rid of the nitrocotton dust. It was a fine, dry, cold morning, and the men were wearing rubber overshoes which would insulate them from electric contact with earth. The bags were of rubber impregnated canvas, marked di-electric, and the operation of wiping the bags would have the effect of generating in the person of the worker, a statical charge of electricity which might well be sufficient to cause a spark to pass, and so set up an explosion as soon as he should happen to earth himself by touching an uninsulated article.

Nitrocotton shows signs of incipient decomposition at a temperature of 49°C., and its stability is affected by exposure to temperature S as low as 30°C.

Collodion nitrocotton, which is a low nitrogen form of nitrocotton, is applied to quite a variety of uses.

1. It is used for photographic purposes when treated with H_2SO_4 .
2. For medical and surgical purposes when treated with ether alcohol.
3. For celluloid when treated with camphor.
4. For lacquers when treated with amyl acetate.

This form of nitrocotton is highly dangerous when in solution with volatile and inflammable liquids. The film which is left after evaporating off the solvent becomes highly electrified and is liable to spark; care should, therefore, be taken in re-dissolving in the ether alcohol, as the vapour may be ignited by electric sparks.

Celluloid is a very unreliable substance, its degree of inflammability depending to a great extent on the method of manufacture.

It decomposes at 145°C. and will explode if heated to a temperature of 195°C.

If its manufacture be defective and the nitrocellulose insufficiently stable, it may detonate even when exposed to such a gentle heat as is given by the sun's rays or the radiant heat of a lamp, and many accidents have resulted from this cause. So far, attempts to diminish its explosibility by the addition of inorganic salts have not met with much success.

Nitrated Straw

Nitrated straw presents a certain risk as it is liable to decompose spontaneously, and will explode at a temperature of 170°C. This fact should not be overlooked, as straw is sometimes used as a wrapping for carboys containing nitric acid.

After experimenting for two years, it is announced that the BRITISH DYESTUFFS CORPORATION have discovered at their Huddersfield laboratories the secret of manufacturing alizarine cyanine green dye on a commercial scale, a German secret hitherto. Alizarine cyanine green was discovered at the works of Fr. Bayer & Co. in 1894, and was made exclusively by Germany before the war. The exact chemical details for its manufacture were jealously guarded. No information was given to chemical associations or allowed to appear in German technical journals. The dye's special characteristics are that when applied upon wool, chromed or unchromed, fine green shades are produced which are fast to milling (shrinking) and very fast to light and sun. In other words, the dye will not fade in sunshine or rain. Since the outbreak of war woollen manufacturers have been unable to produce varying shades of the fastness of alizarine cyanine green.

Manufacture of Dyes & Fine Chemicals in America

The Longworth Protection Bill

This article has been written by a technical chemist who has made a special study of the legislature proposed in America in connection with the chemical industry of that country. Serious efforts are being made in the U.S.A. to establish a fine chemical industry, but results as yet are somewhat disappointing, and the prospects—in view of threatened competition from Germany—are decidedly uncertain.

THE view is very strongly held in America, as in this country, that it is no exaggeration to say that the peace of the world is closely bound up with the development of a great dye industry in Britain and America. The keenest controversy was waged before a sub-committee of the American Senate engaged in hearing evidence for and against the protective measures, both licensing and tariff, of the Longworth Bill. The chief argument of the Bill's supporters was based on the plea of national security and the intimate relation between the manufacture of dyes and the manufacture of munitions.

There is no doubt whatever that the Germans are making the most desperate attempts to regain and extend their former powerful monopoly, notwithstanding the many rumours from German sources that the German dye industry is in a bad way and that no serious competition is to be feared. These rumours are mere camouflage designed to allay apprehension and weaken resolution, and are in direct opposition to the testimony of reliable observers who have seen the German dye factories. Dr. Herty, who has recently returned to America after a six months' trip, arranged by the War Trade Board, to purchase six months' supplies of vat dyes in Europe, is among the latest of these observers; and although he was not able to see inside the German factories he was able to state that 20,000 tons of dyes are ready for immediate despatch to America, and was informed by the directors of the German dye factories that they would get their trade back in America through their own agents, and that American textile interests could not afford to do without German dyes. Major Sill, another visitor to the German chemical works, said that, including intermediates, the total stocks in Germany amounted to about 250,000 tons. It is very difficult to get consistent figures; the Reparation Commission reported that there were 30,000 tons of dyes in the German occupied territory, and as most of the dye works are in occupied territory, this figure should be somewhere near the truth. From a Belgian source it is stated that there are 100,000 tons outside the occupied territory, but these must be mostly intermediates which can only be vaguely estimated. Mr. Choate, who made a four-hours' speech in support of the Bill, and is counsel for the American Dyes Institute, pointed out that the Germans themselves acknowledged they had about 24,000 tons in stock on August 15, 1919. It was recently reported in the German chemical journals that the great German dye cartel had practically doubled its capital, and although the ostensible purpose of this great increase is said to be the development of the synthetic nitrate industry by fixation of atmospheric nitrogen, there is no doubt this work will go hand-in-hand with the development of the dye industry. The Germans' ability to manufacture dyes is one of the strongest weapons in their economic armoury and they will doubtless use it to the utmost.

Protection in America

The American textile manufacturers are in a rather difficult position, for whilst many of them would naturally like to see a firmly established and independent flourishing American dye industry, they cannot disguise from themselves the fact that the difficulties in the way are very great during the next few years, and that the industry at present is in a very embryonic state. Nevertheless some of them spoke in favour of adequate protection in their evidence

before the sub-committee. Mr. F. D. Cheney, of the firm of Cheney Bros., Silk Manufacturers, South Manchester, Conn., said that a tariff, however high, would not be sufficient. "The situation is entirely different from that which our other industries faced in building up. . . . The Germans have on hand enormous stocks of dyes which they must sell either to us or to China. They can afford to give up these dyes for a time rather than lose their industry. Our requirements in all lines of dyestuffs for one year are valued at 35,000,000 dollars. . . . Dye-consuming industries here will be facing bitter competition in their own lines if Germany regains her dye monopoly." Mr. Franklin W. Hobbs, President of the Arlington Mills of Mass., also supported the Longworth Bill.

On the other hand, there was considerable opposition by other members of the textile and allied industries. Foremost among these was Colonel J. P. Wood, of Philadelphia, who said that the textile manufacturers needed certain German dyes and did not want to be at the mercy of American makers or of official or unofficial boards and commissions. A representative of the hat manufacturers also opposed the Bill and said that his firm was held up a little while ago for lack of dyes. Although the American makers had made progress with certain dyes, the quality of some of them was still deplorable, especially the blues. The representative of the hosiery interests echoed the same sentiments, and said that 800 firms in the American Hosiery and Underwear Association are opposed to the Bill.

One of the chief arguments urged by Mr. Choate in favour of protection was based on the plea of national security. This view was strongly disputed by Colonel Wood, and Herman Metz, a well-known importer of dyes, said that coke ovens would be far more important than a dye industry from the point of view of national defence.

American Difficulties

Concerning the present position of the American dye industry the evidence was not very cheerful. Although one witness pointed out that the number of dye plants had increased from 6 to 160, a rather depressing account of the enormous difficulties and cost was given by Mr. Irene Du Pont, of the great firm of E. I. Du Pont de Nemours, of Wilmington, explosive and general chemical manufacturers. The main reason for the high cost of dyes, said Mr. Du Pont, was the excessive loss of material and the cost of labour, including a tremendous amount of research work. Repair costs are also very high. His firm, after losing 300,000 dollars, was now engaged in mass production of indigo, which they were selling at 75 cents per pound. They hoped to improve the process and reduce the price in 1920. Utilisation of by-products was a difficult problem. In the manufacture of synthetic camphor, Du Ponts have produced about 200,000 gallons of oil which they do not know what to do with, although they have a staff of 500 chemists, 300 of whom are engaged on research. Mr. Choate had previously stated that the National Aniline Co. put 800,000 dollars into the manufacture of alizarin before it got a dollar back, and Du Ponts spent over a million dollars on vat dye work before they could produce anything saleable. Mr. Du Pont thought that the two-year protective period provided by the Longworth Bill was not long enough; five to 10 years at least were needed.

Closely associated with the manufacture of dyes is that of fine chemicals or reagents. Here, again, the Germans, as represented by the well-known firms of Kahlbaum and Merck, had practically a world monopoly before the war. Serious efforts are being made in the U.S.A. to establish a fine chemical industry in that country, but the results so far obtained are rather disappointing, and the prospects in the face of a threatened renewal of German competition are, to say the least of it, somewhat uncertain. Some of the big firms, however, like the Eastman Kodak Co., for example, hope ultimately to surmount all difficulties.

Decline in Quality

According to the U.S.A. Bureau of Chemistry, the chemicals examined by that department during 1915-19 showed a marked decline in quality compared with those of pre-war days. Not only was the proportion of unsatisfactory samples greater, but the defects in most cases were more serious. This was particularly the case with certain organic solvents, and to a less degree with the most soluble salts, except the alkali salts. On the other hand, the heavy chemicals, including the mineral acids (sulphuric, &c.), and ammonia, were found satisfactory. Of the organic reagents methyl alcohol was nearly always contaminated with acetone, whilst perfectly pure amyl alcohol, benzene and acetic acid were practically unobtainable. Most of the samples of acetic acid were 99 per cent. or lower. The metallic salts were not very good—the mercury salts, for instance, nearly always contained iron, and the zinc salts and oxides contained lead. The worst samples were found in the hydroxylamine and phenylhydrazine salts, and in the class of insoluble or difficultly soluble compounds. In this latter class satisfactory samples were rarely obtained. Some particularly bad samples included animal charcoal, calcium oxide and lead salts.

Notwithstanding this rather unsatisfactory state of affairs, strenuous attempts are being made by certain enterprising firms to establish a fine chemical industry in the U.S.A. Foremost among these is the Eastman Kodak Co. In a Paper recently read before the division of Industrial and Engineering Chemistry of the American Chemical Society, Mr. C. E. K. Mees, a member of the research staff of the Eastman Kodak Co., stated that the preparation of synthetic organic chemicals was commenced in the research department of his firm in September, 1918. Considerable assistance in the supply of necessary materials was rendered by the American chemical manufacturers and by the universities. Lists of chemicals manufactured were issued monthly, and the last monthly issue included about 550 chemicals. So far the work has been carried out at a loss, amounting during the 12 months ended September 30, 1919, to nearly £3,000, not including rent and other overhead charges. At the end of the financial year there was a heavy stock of chemicals on hand, many of which had fallen considerably in price. Although sales are now increasing rapidly it is not anticipated that the department will pay expenses this year, even with some increase in the prices which will be inevitable. It is believed, however, that with the support of the American chemical industry, the venture will be ultimately self-supporting, although German competition will doubtless be keen.

In a letter to the *Glasgow Herald* regarding the SALARIES OF INDUSTRIAL CHEMISTS and the present over-crowding of the Chemical Departments of the Universities and technical schools, "LIVING WAGE" states that: In the laboratory of one large Glasgow firm the wages range from 18s. to £2 6s. per week. The chemist in charge, who is responsible for the chemical test on the raw materials and finished products, in addition to assisting the training of the junior chemists, receives the handsome living wage of £2 10s. per week."

A Recent Research Appointment

To the Editor of THE CHEMICAL AGE

SIR,—Some members of the National Union of Scientific Workers have drawn my attention to the articles which have appeared in THE CHEMICAL AGE in which the activities of the Glass Research Association, more particularly with reference to the appointment of Mr. R. L. Frink as director of research, have been reviewed. On behalf of this Union, the Right Hon. F. D. Acland put the question to the Lord President of the Council which evoked the reply from Mr. Fisher, quoted in your issue of April 17.

We must take exception to the statement, "In view of the criticism excited by the appointment, however, the Advisory Council held an inquiry into the matter, and after considering all the relevant circumstances with great care, recommended the approval of the expenditure involved in this director's appointment." It is probable that the Advisory Council have met, since protests against the appointment were received from this Union and other bodies, but the Department of Scientific and Industrial Research, before receiving these protests, had made the statement, "The Advisory Council having learned the circumstances of the case, the present conditions of the industry, and the considerations which had influenced the Council of the Association in their choice, approved the expenditure involved," which statement obviously does not differ in substance from that of Mr. Fisher in Parliament. Naturally enough, Mr. Fisher gave no hint of his own opinion as he was answering for a department whose policy is not under his influence or his control. We might reasonably assume that his opinions would differ from those of the Departmental Officials; it is by no means unique in the history of the Board of Education for that body to withhold or to refuse grants to institutions in which the qualifications of the principals are not approved.

We cannot agree with you that to have withheld financial sanction was practically the only alternative to the course adopted; or had such a course been adopted that it would have been impolitic. The incident is by no means closed; the principle involved is one for which some bodies of scientific workers will continue to fight, considering that in so doing they are furthering a cause vital to the interests of the nation in general and to scientific workers in particular.

To those of your readers who are interested in the activities of the Department of Scientific and Industrial Research we extend a cordial invitation to be present at a meeting to be held at Birkbeck College on Wednesday, April 28, at 8 p.m., when Professor Frederick Soddy, F.R.S., will give an address on "The Public Support of Scientific Research." Mr. H. G. Wells will preside, and will be supported by eminent workers for the cause of science.—Yours, &c.

National Union of
Scientific Workers.

April 19.

A. G. CHURCH, Secretary.

The Fine Chemical Trade

To the Editor of THE CHEMICAL AGE

SIR,—Your correspondent is to be congratulated upon his lucid statement of the present position of the British Fine Chemical Industry, and I believe manufacturers will accept it as a statement of fact.

I gather from my own observations that whatever scheme or schemes may ultimately be adopted to secure the stability of the industry when foreign competition recommences, the manufacturers are unanimous in their belief that nothing useful can be accomplished except by co-ordination, which your correspondent rightly emphasises is conspicuous by its absence. In spite of this the first practical attempt on these lines has been a failure. What are the facts?

A Government department apparently thoroughly converted to the importance of the British Fine Chemical Trade, and tackled by competent "leaders" of the industry, under the auspices of the Association of British Chemical Manufacturers, convinced the House of Commons of the necessity of protecting fine chemical manufacturers against competition from abroad as a temporary measure and for the purpose of enabling makers to prepare for the "war to the knife" which is looked for when protection is removed.

By co-operation the manufacturers might have informed the

Board of Trade which chemicals it was necessary to import and in what quantities. By reason of the lack of it the only alternative was restriction "en masse" and a scramble for licenses to import many articles very obviously made in this country in insufficient quantities.

I think this lack of co-operation is largely due to a mistaken attempt to devise methods suitable for the industry as a whole. Firstly, because a question of this kind must be thrashed out "round the table," a method impossible where so many are concerned. Secondly, because of the impossibility of devising any single scheme which would meet the requirements of the varied interests. On the other hand, there can be found groups of manufacturers whose interests are obviously identical. Let each of these comparatively small groups endeavour to find a basis for joint action, keeping in mind the possibility of eventual combination of all groups in the more comprehensive scheme of co-ordination which would undoubtedly grow out of the smaller beginning.

I gather from your correspondent that he is a maker of salicylic acid, and as such I invite him to abandon his nom-de-plume, and identify himself with other makers of this product, who, I believe, are more than willing to get together and demonstrate what practical co-operation means.

I suggest we finish talking about it and make a start; a sample ounce of practice will be worth a ton of theory (especially as the latter is mostly offered for "forward delivery") in convincing those who hesitate and who evidently are not yet convinced that "faith without works is dead."—I am, &c.,

London Chemical Works, Ltd.,
Southall, April 21.

RALPH J. PUGH.

Atomic Weights and Numbers

To the Editor of THE CHEMICAL AGE

SIR,—On studying Dr. Miall's equations connecting the atomic weights and atomic numbers, I find that by letting x represent in his third set of elements (as it does in his first) the atomic numbers, the elements are made to fall on lines of the same system as those on diagram 1, and hence are parallel to these lines.

Neglecting the elements which are mixtures of isotopes, we have—

74	W	.....	$2 \times 74 + 36$
76	Os	.....	$2 \times 76 + 39$
77	Ir	.....	$2 \times 77 + 39$
78	Pt	.....	$2 \times 78 + 39$
79	Au	.....	$2 \times 79 + 39$
81	Tl	.....	$2 \times 81 + 42$
83	Bi	.....	$2 \times 83 + 42$
84	Ac A	.....	$2 \times 84 + 46$
86	Nt	.....	$2 \times 86 + 50$
90	Th	.....	$2 \times 90 + 52$
91	U _{x2}	.....	$2 \times 91 + ?$
92	U	.....	$2 \times 92 + 54$

This gives a straight line through Os, Ir, Pt and Au, one through Tl and Bi and possibly four others when the isotopes of Hg, Pb, Th, Em, Ra, Ac, Io, and the atomic weights of U_{x2} are known.

The same system might also be quite well adhered to in the second group. It is true that this would make one or two elements appear as isolated from any lines parallel to $y = Mx + a$ but it also appears that these elements have atomic weights which give promise of isotopes.—Yours, &c.,

Addiscombe, April 13.

J. H. ALLWORTHY
B. Sc.Lond., F.C.S.

Patent Royalties for Government Employees

According to the provisions of a Bill which has been passed by the U.S. Senate, STATE employees are to receive a portion of any royalties which may accrue from patents which may be made of discoveries or inventions made or developed on Government time. The Federal Trade Commission is assigned the duty of administering the patents for the benefit of the public. The President is to fix the percentage which is to be allowed the employees.

Features of the New Budget

THE Budget introduced this week by Mr. Austen Chamberlain touches industry in a very direct fashion, and several of its provisions are being actively opposed by the commercial community. The most objectionable is the increase from 40 to 60 per cent. of the Excess Profits Duty at a time when all the available capital is needed for the development of national business. The principal points in the Budget are summarised below:—

Excess profits duty increased from 40 to 60 per cent. from January 1 last. (Increase to be cancelled if war levy is imposed.)

Tax of 1s. in the pound on profits of limited liability companies after first £500.

Duties on spirits increased from 50s. to 72s. 6d. the proof gallon.

Beer duty raised from 70s. to 100s. the standard barrel.

Motor-cycles and vehicles used for trade purposes to pay duty according to weight; vehicles used as hackney carriages by seating capacity; and motor-cars £1 per horse-power unit.

Income-tax rate unchanged, but Royal Commission's proposals as to differentiation and graduation adopted. The wife allowance is in effect increased from £50 to £100.

Exemption from tax for total assessable incomes not exceeding £135, or £225 in the case of married couples. Where the income is wholly earned, these limits are equivalent to £150 and £250 respectively.

Super-tax exemption limit lowered from £2,500 to £2,000; rates increased up to 6s. maximum under graduated scale.

Land Values Duties repealed; repayment of duty already paid may be claimed.

New postage rates—inland letters 2d. for 3 oz., and 1d. per additional ounce; newspaper post 1d. up to 6 oz., and 1d. each additional 6 oz.

Telegrams, 12 words 1s.

Higher telephone rates. (Proposals to be laid before a Select Committee.)

Balance-sheet for 1920-21 shows estimated revenue £1,418,300,000; expenditure, £1,184,102,000; balance, £234,198,000, available for debt reduction.

Bombay Glass Industry

WITH a view to developing the glass industry of Bombay the Director of the Geological Survey has taken up the proposals recently made by interested parties and is arranging for an exhaustive examination into all the sand deposits in the Bombay Presidency in order to ascertain whether more extensive use cannot be made of them in glass manufacture. Initial work has already begun in this direction. A conference is being held, the *Times Trade Supplement* states, between representatives of the Bombay glass industry and the Government, at which the present position of the manufacturers will be made clear, and proposals put forward for the adoption of measures, fiscal and otherwise, for the assistance of the industry. The prices of raw materials and the cost of labour is also to be gone into, but the general opinion in Indian glass making circles is that both these are minor matters as compared with the question of foreign competition. Some go so far as to advocate some measure which would have the effect of preventing glass made in Allahabad being sold in Bombay, untaxed or unrestricted in amount. This extreme section argue that Bombay City, where some half-dozen glass works have already been established, is some distance from both the coal and sand districts. Consequently all fuel and practically all raw material has to be railborne, and the industry consequently has no protection against foreign or inter-State competition as has a place like Allahabad, where ample supplies of coal and sand exist. The suggestion is now made, and is likely to be adopted, that the Department of Industries for the Bombay Presidency shall devise a scientific costing system and arrange for its introduction into two or more local factories in order to ascertain the exact costs of production.

A message from Melbourne states that the Australian Federal Government is placing the whole of the OIL BORING OPERATIONS AT PAPUA (New Guinea) in charge of the Anglo-Persian Oil Co. The operations are being extended to German captured territory. The Commonwealth Government has a representative in the field.

An Apparatus for Measuring the Vapour Tensions of Volatile Liquids

By A. V. C. Fenby, B.Sc., F.C.S.

THE apparatus is based on the barometric or static method of determining the vapour tensions of liquids. This method, as usually carried out, presents difficulties and gives results which are frequently discordant, even to the extent of 10-25 mm. for the same liquid as obtained by different observers. These difficulties and sources of error have been indicated and discussed by A. Smith and A. W. C. Menzies (*Jnl. Amer. Chem. Soc.*, 1910, page 1412), and are mainly of three kinds:—

1. *Temperature*.—Difficulty of obtaining uniform heating by vapour or liquid baths, chiefly due to the inadequate stirring arrangements, and errors due to failure to correct the temperature readings.

2. *Pressure*.—The correction of the barometer and vapour tension readings to millimeters of mercury at 0°C. is not made, or if made, is not specified, and, in addition, the gravity correction is seldom made, although in places of widely differing latitude it may amount to 0.25 to 0.5 mm. per atmosphere.

3. *Impurities*.—This is the most serious source of error, and probably accounts mainly for the inconsistency of the results of different observers. The presence of dissolved gases in the liquids is the chief cause of error and varies with the method employed; in barometric methods it is especially troublesome. Since the gases oxygen, nitrogen and carbon dioxide are much more soluble in other liquids than in water, they therefore exert a more effective vapour tension and are less quickly and more difficultly removed by boiling and other methods than in the case of water. Most observers are content to boil for a "few minutes" or for "some time," and few have made attempts to repeat the boiling-out process until constant results were obtained. Most of the methods used do not admit of this repeated boiling, but it has been attempted by a few observers, including Raoult and Beckmann, and more particularly by Vanstone (*Jnl. Chem. Soc. Trans.*, 429, 1910), who employed a Fleuss Pump connected to the upper end of his vapour tension tube to remove air from the tube and from the substance (camphor). The apparatus described was designed to obtain the following advantages:—

1. Easy adjustment and manipulation.
2. Complete removal of air from the barometer and vapour tension tubes.
3. Removal of dissolved gases from the liquids.
4. Means of repeating the boiling out or removal of gases at the end of a set of observations.
5. The easy removal of the liquid from the apparatus and cleaning and drying of the tube.
6. Avoidance of correction for the mercury meniscus depression.

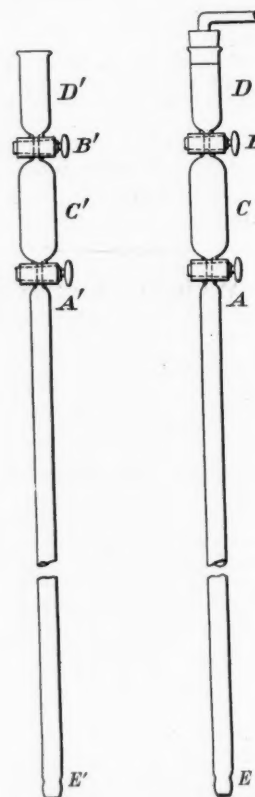
Apparatus.—The apparatus consists essentially of two similar barometer tubes of special construction fixed to a suitable stand and connected at their lower ends by thick walled rubber tubing to a mercury reservoir, or preferably, each to a separate reservoir, which can be raised or lowered. One of these tubes is used as a barometer, and the other, which is surrounded by an outer jacket, as the vapour tension tube. These will be described separately.

The Barometer.—The barometer tube is of special construction. At the upper end it is provided with a tap "A," and above this a considerably wider portion "C," which is also provided with a tap "B," and a small mercury cup "D" above the tap "B." The chamber "C" above the barometer tube serves as a vacuum chamber, and is used for removing traces of air from the tube in the manner explained below. The use of a tap a: the top of the barometer presented no difficulties, and was quite satisfactory, as shown by repeated tests. The use of a mercury sealed tap is still better.

Methods of Filling the Barometer, and Its Adjustment

(a) To fill the barometer the taps are opened and mercury slowly run into the tube by raising the reservoir, until the tube and the vacuum chamber are filled, and some mercury enters the cup. The tap "B" is closed and the reservoir lowered until the chamber "C" is empty and about half the barometer

tube. The tap "A" is then closed, leaving a fairly good vacuum in "C." The mercury in the tube is now lowered nearly to the bottom of the tube, and then gradually raised to the tap "A"; it is lowered and raised several times. Bubbles of air rise from the side of the tube, and, when the mercury is raised, a quantity of air is found below the tap. The tap "A" is now opened, a little mercury is forced into "C" and the tap closed. This pumping out of air at low pressure is repeated several times and the air expelled into "C." Soon it is found that when the mercury is allowed to come up against the tap, a distinct metallic click or bump is produced and practically all air has been removed. The tap "A" is now



VAPOUR TENSION APPARATUS.

opened and mercury allowed to enter "C"; the expelled air is then removed by opening the tap "B" when mercury enters from the cup "D" and the air escapes. The tap "B" is closed, and to ensure the complete removal of air, "A" is opened and "C" emptied, and "A" closed. The mercury in the tube is run several times down and up the tube, and any air which collects is passed into "C" with a little mercury and "A" closed. The barometer is now tested by lowering the mercury a little and allowing it to gently bump against the tap. The click is now more pronounced. The barometer is then set by lowering the reservoir until the mercury is a few centimetres below the tap, and the level of the mercury in the reading tube (of the same internal diameter as the barometer tube to avoid error due to meniscus depression) is at the zero of the scale fixed by the side of the barometer tube.

(b) A better method of working is to pack the cup "D" with lumps of fused calcium chloride and close it by a cork fitted with a tube bent at right angles and closed by a stopper. The taps being opened and the stopper removed, the baro-

meter tube and chamber "C" are filled with mercury and air slowly drawn into the tube by lowering the reservoir, and expelled by raising the mercury; this is repeated several times and the tube heated during the process. This removes moisture from the tube and a large proportion of the air. The filling and adjustment is then carried out as described under (a). The barometer may be enclosed in an outer jacket for heating by water or steam, and after the adjustment it can be maintained at a steady temperature by filling the jacket with water.

The Vapour Tension Tube

This is similar to the barometer tube, but is enclosed in an outer tube or jacket so that it can be cooled or heated by means of liquids or by passing steam or other vapours through the jacket. When liquid baths are used a long wire spiral stirrer is used, which extends nearly the length of the jacket and only requires a small up and down movement to agitate the whole column of liquid. The tube is filled with mercury and air removed as in the barometer tube. The chamber "C" is left vacuum and a little mercury above the tap "B" in the cup "D". A quantity of the liquid is placed in "D", and by carefully opening the tap "B" a few cubic centimetres are allowed to enter the chamber "C", and the tap "B" closed. A large proportion of the dissolved gases is removed from the liquid in the chamber "C". By opening the tap "A" and slowly lowering the mercury in the tube a small quantity of the liquid is introduced into the tube and the tap "A" closed. By lowering the mercury reservoir until the mercury has fallen to within a few inches of the bottom of the tube, the liquid is made to rapidly evaporate under low pressure and gases are removed from solution in the liquid. These gases are then collected by raising the mercury and are passed into the chamber "C". The process is repeated several times until no more gas collects and the liquid bums with a sharp click against the tap. The tube, if necessary, is heated a little during this process. The liquid is then cooled or heated to the temperatures required and the vapour tensions measured. The readings are reduced to millimeters of mercury at 0°C., and also the barometer reading, before taking the vapour tension reading. To avoid error due to meniscus depression in the tube in contact with liquid being different from that in the reading tube attached to the mercury reservoir a drop of the liquid is placed above the mercury in the reading tube. This reduces the error to a negligible quantity. The liquid is easily removed by filter paper or cotton wool when another liquid is to be used. The tube is readily cleaned and dried after a set of observations by heating it and raising the mercury with the tap "A" open and driving the liquid and mercury into "C" finally expelling the liquid into the cup "D" and removing it.

After cooling, a little ether may be introduced into the tube and the tubes thoroughly rinsed out with it. The ether is then removed. Dry air is introduced and the tube swept out several times, preferably with heating. It is then filled with mercury, as described above, and compared with the barometer as a test of its dryness and freedom from air, before introducing another liquid.

At the end of a set of observations, the liquid can be cooled and brought to the top of the tube, after repeating the pumping out process, and examined for air or gases, which, if present, can be expelled into "C", and the observations repeated until they are concordant. This method of removing gases from solution in the liquids to be examined has proved satisfactory, and, as far as the author is aware, is novel. In an apparatus intended for purely scientific work a few modifications and improvements are being made, but these do not affect the principles of the apparatus as described.

Vapour Tensions of Mixed Liquids

In measuring the vapour tensions of mixed liquids, such as petrol and petroleum, the removal of dissolved gases by boiling out or by the method of pumping out described above would lead to an alteration of composition by removal of part at least of the more volatile portions. In such cases the pumping-out process is omitted and still further to guard against any change of composition, the chamber "C" is not left exhausted, but, after the filling of the vapour tension tube as described, the reservoir is raised and the tap "A" opened and "C" filled with mercury. The liquid in the cup "D" is then slowly drawn into "C" by opening the tap "B" and lowering the reservoir until "C" is filled and a little enters the tube. The tap "A" is then closed, but "B" is left

open to allow for expansion of the liquid in "C" in case it gets heated during the observations.

The results of several experiments made with the original apparatus in 1910 are given below.

Date.	Standard barometer, reduced to 0°C.	Experimental barometer reduced to 0°C.
1910.—April 2	751.0 mm.	751.0 mm.
1910.—April 4	738.0 mm.	737.8 mm.
1910.—April 9	745.6 mm.	745.8 mm.
1910.—June 15	759.6 mm.	759.7 mm.
1910.—June 16	758.5 mm.	758.7 mm.
1910.—June 24	738.9 mm.	738.9 mm.

Vapour Tension of Water.

Temp. °C.	Bar. (Corrected to 0°C.)	V. tension reading. (Corrected to 0°C.)	Vapour tension in mm. of Hg. at 0°C.	Vapour tension (Kaye & Laby's Constants).
5.0	736.2	730.1	6.1	6.5
11.0	736.2	726.2	10.0	9.8
17.5	736.2	720.0	16.2	15.9
24.5	736.2	713.1	23.1	23.0

Vapour Tension of Alcohol.

Temp. °C.	Bar. (Corrected to 0°C.)	V. tension reading. (Corrected to 0°C.)	Vapour tension in mm. of Hg. at 0°C.	Vapour tension (Kaye & Laby's Constants).
19.8	736.4	693.7	42.7	42.7
27.0	736.4	671.9	64.5	65.9
30.0	736.4	657.2	79.2	78.4
33.0	736.4	645.1	91.3	91.9
37.5	736.4	619.9	116.5	116.6
40.0	736.4	602.4	134.0	133.4
43.0	736.4	578.2	158.2	153.9

The Ideal Trade Paper

As our readers are aware, THE CHEMICAL AGE forms part of a big trade paper organisation controlled by Benn Brothers, Ltd. A subscriber, whose opinion we value, suggests to us that this arrangement is likely to have an influence upon the policy of the paper, and that, as part of a powerful combination, it cannot be so wholeheartedly part and parcel of the chemical industry itself as if it were run as a single publication. We are obliged to our correspondent for giving us an opportunity of reminding our readers of the advantages which come to them from the association of THE CHEMICAL AGE with a group of powerful trade journals. The great obstacle to success in trade journalism of the older kind is that, while it may well be an authority on the industry which it represents, it is quite impossible for a single journal of a trade or technical class to support an adequate and efficient publishing organisation. To be of use to its industry a trade paper must not only contain the very best matter available, but it must also be circulated in the proper quarters. It is the obligation of the proprietors to see that the journal is regularly brought to the notice of all those persons the world over who should take an interest in the industry which it represents. It is obviously impossible to send a representative into some outlying district in the hope of interesting a single individual who would be of service to the readers of a single paper. Benn Brothers, Ltd., on the other hand, are able to maintain a thoroughly efficient publishing staff, with agents and representatives in every corner of the industrial world, and it is in this way that they are able to secure a circulation for each of their journals which none of them could hope to attain working single-handed. The same principles apply to the collection of news and to many other of the essential parts of a publishing organisation. THE CHEMICAL AGE enjoys all the advantages and facilities of the most up-to-date publishing concern of its class, while the editorial and advertisement sections are still exclusively devoted to the single service of the chemical industry. The net result is that our readers get a much improved service, and that our advertisers secure a publicity which is unrivalled in the industry which it is our purpose to serve.

Chemical Engineering Group

Annual Meeting and Dinner: Relations with the Parent Society

THE Chemical Engineering Group of the Society of Chemical Industry held its first annual meeting and dinner at the Waldorf Hotel, London, on Thursday, April 15. The proceedings of the annual meeting, which was presided over by Mr. J. A. Reavell, were very brief, and consisted mainly of the presentation of the reports of the hon. treasurer and the hon. secretary. There were no points of outstanding interest in either, the work of the Group during the first year of its existence having followed the lines laid down in the preceding period of organisation. The accounts show a credit balance of £20, and, according to the hon. treasurer's statement, only 310 of the 510 members have renewed their subscription for the coming year. It was not made clear whether this large number had dropped out or whether the subscriptions were merely overdue.

The hon. secretary in his report made reference to the sudden breakdown in health of Prof. J. W. Hinchley, which has considerably hampered the work of the Group in certain respects. Prof. Hinchley has been succeeded as convener of the Data Sheet Sub-committee by Mr. J. H. West, who was appointed during the year, under rule 10, to succeed Mr. A. J. Liversedge, who had resigned for private reasons.

The Committee having elected as their chairman for the coming year Mr. J. A. Reavell, there were four vacancies on the Committee, and these have been filled by the election of Messrs. J. H. West, H. F. V. Little, Dr. W. R. Ormandy and E. Hill. The donations to the funds of the Group, apart from subscriptions, amount to £195; but the chairman explained that this was a work which Prof. Hinchley had had specially in hand, and his illness to some extent accounted for the smallness of the amount in hand, because no special efforts had yet been made to secure donations. The admirable work of Prof. Hinchley and Mr. Talbot, the hon. secretary, was referred to by the chairman at the close of the meeting.

The Annual Dinner

The dinner was presided over by Dr. E. F. Armstrong, F.R.S., vice-chairman of the Group, the principal guests being Mr. John Gray (president of the Society of Chemical Industry), Mr. W. J. U. Woolcock, M.P. (general manager of the Association of British Chemical Manufacturers), Engineer Vice-Admiral Sir George Goodwin, F.R.S. (president of the Institute of Metals), and Prof. F. G. Donnan, F.R.S.

The Group and the Society

The first toast, that of the "Society of Chemical Industry," was proposed by Dr. W. R. Ormandy, who referred to the satisfactory relationship between the Group and the Society. He thought that the Group had done the wise thing in electing to ally itself to, and not to separate itself from, the Society, although there had been times when he had had his doubts about the matter. He felt that the Group, by its vigorous policy, had done a great deal towards inducing a more active policy on the part of the Society. He noticed that the Manchester section of the Society had seen fit to hold an exhibition of chemical engineering apparatus in Liverpool on the same day that the quarterly meeting of the Group was held in that district. However, the Group was not at all jealous. It was desirable that every section should hold as many meetings as possible dealing with the various aspects of chemical engineering and chemistry of special interest in the particular districts, and it was because they recognised the great importance of this that the Group had decided at considerable expense to hold quarterly meetings in various towns. It was in connection with this work that their hon. secretary, Mr. Talbot, had done work which the total income of the Group would not adequately repay.

There never was a time in the history of the country when it was more necessary that all jealousies between one section and another should be set aside, and the Chemical Engineering Group was one at heart in desiring to work in the utmost harmony with the parent Society and the other sections. It was possible that the parent Society, in its Committees, had sometimes

thought that the Group was trying to make greater progress than their means allowed, and they had been tempted, perhaps, to put the brake on more than was desirable; but he could only say that the one thing which the Group desired more than another was that the whole industry should flourish, and that personal animosities and jealousies should be wiped out. He coupled with the toast the name of Mr. John Gray, the president of the Society of Chemical Industry. The Society had never had a president who had done so much for it, and, from his own personal knowledge of Mr. Gray, he knew that they could look upon him as a court of appeal in any difficulties they might encounter. He had shown a keen interest in the work of the Group and the greatest desire to help in every possible way.

Mr. John Gray

Mr. John Gray, in reply to the toast, said the Council of the Society was really most anxious to help the Group, which was young and vigorous, and anything which the Council might do must not be considered as being with the intention of curbing the activities of the Group. First of all, however, the Council must know in what way it could help the Group, and therefore it was necessary that the Group should take the Council fully into its confidence. He was perfectly certain that the Council and the Group understood each other now better than they had done at any time previously, and he urged the Group to come forward with its suggestions, because the ultimate aim was to improve and develop the activities of the Society as a whole. That could only be done by means of a closer relationship between the Society and the sections and the subject groups, because, although there was only one at present, he hoped that in the future there would be considerably more than one. The enthusiasm of the sections and the groups was of the highest importance to the Society and its development. At present the Council of the Society was fighting a very hard up-hill game. Circumstances were very much against them, and it was a difficult matter for the Council to make the progress it would like. In fact, it was a hard enough job to keep going; but they were not alone as far as scientific societies were concerned. He believed it was rather a chronic complaint at the present time; but, if they were to maintain their position, they wanted every member of the Group and every member of the sections to do their very utmost to increase the membership and to do everything possible to increase the revenue.

As engineers they did not need to be reminded that everything had gone up enormously in cost. In the *Journal* the Society had a fine asset, and the Council was determined that nothing should be done to reduce the value of it, nor to reduce the *Journal* either in character or efficiency; but that could only be effected if they had the wherewithal. He hardly thought it possible that the Society could continue much longer without making an increase of some sort in the subscription. He was in touch with many of the local sections, and was perfectly certain that members would much rather this were done than that the efficiency and character and extent of the *Journal* should be interfered with. He was glad to notice from the way in which his remarks had been received that evening that those present were in accord with that view; but, whilst the ideals of the Council were as he had suggested, the task was impossible without the support of the members. The whole question was now under the consideration of the Council.

The Chemical Engineer

Mr. W. J. U. Woolcock, M.P., general manager of the Association of British Chemical Manufacturers, who proposed "The Chemical Engineering Group," said that from the report of the Commission which was sent to Germany by the Association of British Chemical Manufacturers, in which the value of the chemical engineer was clearly brought out, it was perfectly obvious that a good piece of work had been done in the formation of the Chemical Engineering Group. It was due to the shortage of chemical engineers in this country that we had to bring Mr. Kenneth B. Quinan over here in the early days of the war to do work which it would never have been necessary

for him to do had the Chemical Engineering Group been in existence years ago. He thought the Group had been wise in deciding to work as part of the parent Society, and he believed ultimately they would achieve in an even greater degree for Great Britain what had already been achieved in Germany in connection with chemical engineering.

Mr. J. A. Reavell, chairman of the Group, responded. His definition of a chemical engineer was that he was a chemist when talking to an engineer and an engineer when talking to a chemist. For some years before the war British manufacturers had had an exaggerated idea of the value and knowledge of the German chemical engineer. It had only been necessary for a German to come here and talk in broken English and a British manufacturer would be willing to pay 20 and 30 per cent. more to the German for English patented goods made in Germany. If the Chemical Engineering Group worked in the future as hard as it had worked in the past there was no need to fear for the future. Already manufacturers had been brought together in a manner which would never have been considered possible in the past, and, instead almost of passing each other by in the street, manufacturers now consulted together on many matters. Another thing the Group could do was to assist in seeing that the technical colleges were equipped with up-to-date apparatus for training purposes. At the present time many of them were not so equipped. Some complaints had been made by members that the Group had not done all it might have done, and in that connection he wished to refer to the lamentable illness of Prof. Hinchley. No man had done more for the Group, and at the time when he was so suddenly taken ill he had many matters in hand which had been delayed in consequence. But for the illness of Prof. Hinchley the Group would have issued several publications before now.

Overcrowding of the Industry

Dr. E. F. Armstrong, F.R.S., proposing the toast of "Our Guests," said that it was only natural that the desire of the Chemical Engineering Group to strive after new and bigger things should bring it into collision with the older and more staid body; but that was wholly to the good, and would lead British chemists and British chemistry to a far higher place in the activities of the State if they succeeded in directing their energies along sound lines. It was most important, as Dr. Ormandy had recognised, that they should all pull together, and he had always held the opinion that the Group did a wise thing in deciding to work as a part of the Society. It was quite true that at a certain period prior to 1910 the Society of Chemical Industry has got into a state of complacent self-satisfaction; but since 1910, and certainly since 1913 or 1914, the infusion of new blood into the Society had altogether changed its activities. It was necessary to keep building up, but this could only be done if they had heaps of new ideas and ample finance. Certainly they could not go on building up if there was only destructive criticism. Chemistry was an enormously big field, and there were so many sections to it that a man in one was hardly conversant with the language of a man in another. Therefore, anything that could be done to bring the various branches of the industry together would be all for the good. The weapon of the chemist was chemistry, and his knowledge should be as wide as possible.

One result of the war, and what chemistry had done in connection with it, was the danger that large numbers of young men were being sent to the universities and colleges to study chemistry. The consequence was that the chemical industry was going to be very much overcrowded in the near future, and that would inevitably lead to competition for positions, and possibly reduced emoluments and profound dissatisfaction on the part of both the employer and the chemist. It could not too often be stated that there was very little room for half-trained chemists, for the three years pass man, or even for the B.Sc., and that only those who could afford to spend five or six years on their training could be assured of the highest positions. He coupled with the toast the names of Engineer Vice-Admiral Sir George Goodwin, F.R.S., and Prof. F. G. Donnan, F.R.S.

Sir George Goodwin said he gathered from the speeches that the chemical engineer was going to govern everything in the future, but in the meantime there would be an opportunity for other engineers to carry on the work that had to be done. One essential thing was that the user should be taken

into consultation by the engineer or chemist and the manufacturer.

The Training of the Chemical Engineer

Prof. F. G. Donnan, F.R.S., commented on the requirements of those concerned in the training of the chemical engineer. It would never be possible to do all that was necessary unless they had the assistance of the practical man, who must come to the universities and give lectures, whilst the manufacturers must be prepared to throw open at least a portion of their works where the students could undertake vacation courses. It was the practical atmosphere which was necessary for the proper development of the student into a real chemical engineer. It was for this reason that he had welcomed with joy the formation of the Chemical Engineering Group, and he looked to their assistance in the directions he had indicated. Mr. Quinan, who was a real chemical engineer, although he confessed that he knew little about chemistry, had started certain work in this country, especially in connection with the fixation of atmospheric nitrogen, which happily, in that it had saved many thousands of lives of our men, the Armistice put an end to; but he was pleased to know that private interests were taking the scheme up, and he hoped it would be completed. Mr. McNab, too, was carrying on another part of the work begun by Mr. Quinan in the direction of collecting documents and records of practical examples of work which had been carried out in this country, and this would be of immense value to the educational people concerned in the training of chemical engineers. The University College was going to have a special building for the training of chemical engineers; but it was not the building or the apparatus that was going to matter so much as the practical atmosphere, and that could only be given by the assistance he had asked for.

Mr. C. S. Garland briefly proposed "The Chairman," who responded even more briefly.

Chemical Trade Inquiries

LOCALITY OF FIRM OR AGENT.	MATERIALS.	REF. No.
Belgium (Brussels)	Heavy chemicals and chemical raw materials	567
Canada (Toronto)	Wholesale druggists, essential oil manufacturers, rubber companies, &c.	...
Canada	Aspirin, phenacetine, permanganate of potash	...
Guadalajara ...	Glass and china, mining supplies, paints, chemicals	592
New Zealand (Wellington)	Chemicals and drugs...	554
Latin America ...	Textiles, paints and varnishes, chemicals	586
Mexico	Drugs and chemicals...	590
Dantzic	Industrial oils, &c.	579
Poland	Oils	580
Australia...	Glass and pottery	505
Canada	Steam gauge glasses	509
Egypt	Vegetable oils for soap-making, margarine	526
Hungary	Foodstuffs, soap and olive oils ...	532

Copenhagen, it is announced, has large quantities of ammonia, sp. gr. 0.910, in glass demijohns, for sale at 69 Swedish crowns per 100 kilogrammes (about 77s. 8d. f.o.b. Malmö or Göteborg; also collodion, ethyl ether, acetic ether and nitric ether.

Carbolic acid, dinitrophenol, and dimethyl anilin oil are required by the Japanese dye manufacturers.

On the abolition of the existing tax on petrol of 6d. per gallon, the SHELL MARKETING Co. announce their intention to make a reduction of one penny in the price of their motor spirit. The price of No. 1 grade Shell spirit will thus be 3s. 1½d. per gallon to the consumer.

The Chemistry of Aeronautics

A Paper before the R.C.S. Chemical Society

By permission of the Superintendent of the Royal Aircraft Establishment Mr. A. W. Chapman was able to include in a Paper read before the Chemical Society of the Royal College of Science on March 24, a discussion of certain chemical problems arising out of the requirements of aerial warfare, the lines along which the problems had been approached, and the results which had been attained in the research. The lecturer confined his attention to the one branch of aeronautical chemistry with which he had himself been concerned, the treatment of aeroplane fabric, and his discourse gained greatly in interest and value from the series of specimens, apparatus and graphs exhibited, which were lent by the Royal Aircraft Establishment and the British Cellulose and Chemical Manufacturing Co., Ltd.

After discussing briefly the nature of the dopes used by the pioneers of aerial construction in the attempt to render fabrics windproof and taut, the lecturer dealt with the preparation of the acetyl and nitro-cellulose dopes, which, by reason of their imperviousness and comparative insensitiveness to atmospheric influences, found general use at the present moment. The solvent media used might include a solvent proper (*e.g.*, acetone, methyl acetate, &c.) forming directly a colloidal solution of the base; a diluent, which, though not forming by itself a colloidal solution, modified the properties of the solvent so as to give a better film more cheaply; *e.g.*, alcohol, benzol, and a softener, a high boiling liquid or solid giving a tough film of enhanced clearness (*e.g.*, tetrachlorethane triacetin, benzyl alcohol, and triphenyl phosphate). The function of these was probably similar to that of camphor in celluloid. Casein dopes had also been employed, but had met with no great success as yet.

Apart from the obvious necessity of wind proofness the dope must pull the fabric moderately tight; excessive tautness, tending to distortion of the wings, might be a disadvantage of certain dopes. The dope must not be greatly affected by water, nor might the tautness be seriously affected by atmospheric changes. The film should not be brittle. The practical non-inflammability of acetyl-cellulose dope films was a notable advantage, and, whilst nitro-cellulose films might be made non-inflammable by the addition of calcium or zinc chloride, this introduced an undesirable complication in the absorption of water by these compounds. A further important point was the chemical inertness of the dope towards the substances with which it came in contact.

Down to 1915 great trouble was experienced owing to the development of acidity in the dopes with consequent corrosion of the containers and damage to the wings; and the partial cause was ultimately discovered in an impure and unstable cellulose acetate containing occasionally a high proportion of free acid. Since the dope was applied in successive coats, its viscosity should be uniform in all samples so that it might be easily applied in the correct amount; and the difficulties arising from the fact that solutions of different cellulose acetates of the same concentration might differ widely in viscosity were obviated by the blending of the cellulose acetates. The humidity and temperature of the air of the doping room had an appreciable effect, a white brittle film resulting from the precipitation of the cellulose acetate under conditions of excessive humidity. Finally the vapours arising from the dope should not seriously affect the workpeople applying it. The fatalities resulting from the continuous inhalation of the vapour of tetrachlorethane led to the abandonment of this softener in 1916, benzyl alcohol being used instead.

Acetyl cellulose was only made by two firms in this country, and the details of the treatment—with acetic anhydride—remained a close secret. Benzyl alcohol was produced at the Royal Aircraft Establishment among other places, the production on a considerable scale not having been attempted in England in pre-war days. The method of preparation was the same as that employed in the laboratory—*viz.*, the chlorination of toluene and the hydrolysis of the benzyl chloride with sodium carbonate or milk of lime.

The chlorination was carried out in lead vessels with lead tops and reflux condensers. The chlorine was admitted into the liquid kept boiling in an oil bath, and the vapours passed through the reflux condenser into water containers to absorb

the HCl. When a specific gravity of 1.01 15°/40 had been attained, the benzyl chloride was siphoned out. It was found to be absolutely essential that all traces of foreign metals should be kept out, since these traces not merely caused nuclear substitution in place of side-chain replacement, but might also induce the Friedel and Crafts reaction. This difficulty was avoided by redistillation of the toluene and scrupulous cleanliness of the apparatus. The pure benzyl chloride obtained by fractionation was hydrolysed with an excess of alkaline solution in large metal vessels, in which it was steam-heated and continually stirred. When the mixture was free from benzyl chloride it was separated and the benzyl alcohol was extracted from the aqueous layer by means of benzene. The earlier samples were obviously impure, and the chlorine present in these proved incapable of removal by fractionation, but a very pure product was obtained later. Benzoic acid was produced from the high-boiling residues by treatment with 75 per cent. nitric acid, the fumes produced in the reaction being led into towers filled with bricks down which water was trickling. In the preparation of the dope from its constituents, to the cellulose acetate in a mixer were added successively alcohol and benzol, the solvent, and the softener, and the mixture were then stirred for about two hours or more till solution was complete.

A problem which confronted chemists engaged in aeronautical work arose from the falling-off in strength of plain and doped fabrics on exposure to the weather. This decrease was suggested to originate in the action of light on the fabric and the effect was investigated of covering the dope with an opaque layer of pigmented varnish (such as PC10, a khaki pigmented varnish with a nitrocellulose medium). The extraordinary preservation resulting is indicated by the following table in which the units of tensile strength employed are kilogrammes per metre.

	Clear dope only.	Clear dope covered with PC10.
Before weathering ...	1728 kg/m	1802 kg/m
After 1 year's weathering ...	407 kg/m	1794 kg/m

That the effect was actually due to sunlight was finally demonstrated by exposing frames of doped fabric for different periods of three months and preparing graphs of (a) the log of the loss of strength ($\log \frac{S_0}{S_t}$), and (b) the total hours of sunshine

recorded; the curves thus obtained were found to be practically coincident. The next step was to find out whether the destructive action were general all along the spectrum or whether confined to one region. The apparatus employed was a quartz spectrograph and a plate wound with linen threads in close contact and covered with tinfoil except for a narrow strip. The method of employing the apparatus was statistical, and depended on the greater chance of the fracture of the thread under tension occurring in the exposed portion which would necessarily follow any reduction in strength during exposure. The plate was divided into a number of sections corresponding to definite regions of wave-lengths, and after exposure for one month in the spectrograph to a mercury vapour lamp the threads were broken one by one, and the proportion of threads in each section which broke in the exposed portion was noted. The effect was thus found to be normal except when λ is less than 3,660 angstrom units, a region well down in the ultra-violet, the rays of which would probably be absorbed very largely in the atmosphere. All attempts at the employment of dyes in the dope were unsatisfactory, either by reason of a tendency to fade, to crack the dope or to interfere with the tautness; and the only satisfactory method of protecting the fabric remained as before, the employment of a pigment.

Another problem was that of tautness. The upper limit was determined by the strength of the wings and the fastenings. With regard to the lower limit it was essential to reduce the sag of the fabric to certain limits. A slack fabric when in flight, especially when exposed to a slipstream might flutter so violently that it eventually became torn away.

Complaints as to the tendency of fabric to become "soggy" *i.e.*, corrugated and soft, led to the suspicion that the humidity of the atmosphere was the determining cause, especially since the soggyness was known to be worst in the early morning. The study of the relationship between tautness and atmos-

pheric humidity necessitated the production and maintenance of constant humidity of varying degrees, its measurement, and the measurement of tautness.

For the latter, perfectly standard conditions were essential. These were provided by stretching fabric at a definite tension over square frames (12 in. sq. externally, 10 in. sq. internally), sticking it rigidly, doping under given conditions and specially drying. The tautness was then determined very simply either by noting the depression of the fabric under a known weight, or by measuring the radius of curvature produced by a definite reduction of air-pressure inside the frame.

The production of varying degrees of humidity required the use of a small room with the two halves separated by a muslin curtain. In one half were placed the tautometer, hygrometer and frames; in the other was a spray fed with water, and the circulation of the air through the room was effected by several fans. The humidity was reduced to 15-20 per cent. by shutting the room up overnight with large trays of concentrated sulphuric acid, and during the course of the day the humidity was progressively increased by adjustment of the water-spray. A further method was to measure the tautness before, and at intervals during, exposure to an atmosphere of 90-92 per cent. humidity, in a thoroughly waterlogged cabin.

For the measurement of humidity a rapid and accurate method with a range of 25-95 per cent. was required. The chemical hygrometer was too slow and the wet and dry bulb thermometer was too sensitive to draughts; but a modification of the latter, the Assmann Psychrometer, in which the bulbs were exposed to a current of air drawn at above a certain rate by a fan, was found to yield very consistent readings, and, the instrument tables being standardised against the chemical hygrometer, proved entirely satisfactory. The earliest experiments considered only the relation between the humidity and the tautness of ordinarily doped fabrics, and a smooth curve was obtained showing a progressive slackening of the fabric with increasing humidity. The slackening of the fabric on absorption of moisture being due mainly to the expansion of the film, this was measured for different amounts of absorption and a smooth curve was obtained. Further comparative experiments in the very moist atmosphere were conducted on plain and doped fabrics. The plain fabric was found to tighten with moisture; the dope film, apart from the fabric, slackened and remained slack; the doped fabric showed a slackening attaining a maximum and followed by a partial tightening.

Exposure of the fabric to weathering was accompanied by another phenomenon besides loss of strength—a progressive slackening in a moist atmosphere. This might possibly be due to the alternate contraction and expansion of the dope film with the changes in humidity producing a loosening of the threads of the fabric. The possibility of obviating the slackening by covering the dope with an impervious layer was investigated and PCro, a pigmented nitro-cellulose varnish was employed.

When the effect of applying the pigment and the dope in an intimate mixture was investigated, it was found that the fabric was equally protected, tighter and even more resistant to weathering than clear dope covered with pigmented varnish.

At the conclusion of his Paper the lecturer answered a number of questions asked by members of the audience, and the meeting then closed with a hearty vote of thanks.

Science and Industry

THE importance of scientific research was emphasised by Dr. J. Hall-Edwards, the X-Ray martyr (who is applying the principle of radiography to metallurgy), at the annual dinner last week in Birmingham of the Institute of Metals. He hoped the day would come, he said, when every important industrial centre would have a well-equipped laboratory for scientific investigations. The scientific apparatus required would be costly, but he felt that manufacturers should be ready to contribute financially, as such an outlay was certain to bring a financial return. Pure science was becoming more and more allied with commerce, and the more this became the case the greater would be the advantage reaped by all classes of the community.

Mr. F. C. A. Lantsberry, industrial chemist (Small Arms Co.), vacates the chair, after a successful year, in favour of Dr. H. W. Brownson, industrial chemist (King's Norton Metal Co.). The membership numbers 219.

Society of Public Analysts

At the ordinary meeting on Wednesday, April 14, at the Chemical Society's Rooms, Burlington House (Mr. Alfred Smetham, President, in the chair), certificates were read for the first time in favour of Miss D. G. Hewer, B.Sc. (London), Miss R. C. H. Johnson, and Messrs. H. Hall, F.I.C., G. T. Bray, A.I.C., F. W. G. King, and J. R. Stubbs, M.Sc. (Victoria), F.I.C.

A certificate was read for the second time in favour of Mr. Laurence Harry Mills, B.Sc. (Birmingham), A.I.C.

Election of Members

The following were elected members of the Society:—Messrs J. Carmichael, F.I.C., H. J. Evans, B.Sc., F.I.C., C. D. Garbutt, D. Henville, F.I.C., M. S. Hutchinson, B.Sc., B. R. James, F.I.C., G. Martin, D.Sc., Ph.D., F.I.C., R. L. Morris, F.I.C., and J. Wood, M.A., B.Sc., F.I.C.

Papers

"The Turbidity Temperature of Fats, Oils and Fatty Acids" (Part I) was the subject of a Paper by Mr. A. E. Parkes, F.I.C., who had systematically studied and worked out the influence on the turbidity temperature caused by traces of water and free fatty acids. He had used as reagents, acetic acid and alcohol side by side for comparison, and reference was made to the previous work of Fryer and Weston and Parkes. The Paper was illustrated by several diagrams and tables.

In a Paper on the "Interpretation of Milk Records," Mr. G. W. Monier-Williams gave a detailed analysis of a series of milk records obtained in 1915 from a certain farm. The fat content of the morning milk was remarkably low throughout. He discussed the possible cause of this, and compared the figures with those published by Richmond. He also discussed the use of frequency curves in connection with milk records, and gave diagrams of the actual frequency curves of milk records from various sources, showing the effect of (1) fat percentage, (2) milk yield, on the form of the curves.

Messrs. A. F. Joseph and G. A. Freak, in a Paper on "The Loss of Free Ammonia from Drinking Water Samples," showed that in the tropics there was a risk that the proportions of free ammonia in samples of drinking water would rapidly diminish. The ammonia was oxidised to nitrates, but this loss might be prevented by acidifying the sample, by addition of toluene or by keeping in ice, thus indicating that the change was caused by bacterial agency.

Mr. E. Sinkinson described "A Decanting and Filter-Washing Machine," which had been constructed to wash precipitates with hot water, or other washing fluids, expeditiously, and with the greatest precision possible. Also a decanter to work in conjunction with the filter-washer for the purpose of assisting the agricultural analyst. The method of construction and working in detail was also explained, together with a device for automatically arresting the mechanism when a precipitate had been completely washed.

Effect of Prolonged Heat on Bleached Cotton

In a preliminary notice on the prolonged action of a moderate heat on bleached cotton and some other substances, contributed to a recent meeting in Manchester, Professor E. Knecht recorded some interesting results which he had obtained by exposing bleached and unbleached cotton and other textile fibres to a temperature of 93°C. for periods up to 530 hours. In all cases the fibres were deeply changed and in some instances there was evidence of incipient destructive distillation. Other common substances such as wood, starch, tannic acid, cork were also found to be more or less profoundly changed under the conditions. Incidentally, it was found that after cotton had been extracted to exhaustion with benzol and other solvents and then bleached in the ordinary way, it yielded on extraction substances similar to those obtained in the first extraction though somewhat smaller in amount. No satisfactory explanation for this remarkable observation was as yet forthcoming, but it would have to be taken into account in the estimation of fatty matter in cotton samples.

Books Received

CHEMISTRY FOR PUBLIC HEALTH STUDENTS. By E. Gabriel Jones. Methuen & Co., Ltd., London. Pp. 244. 6s. net.

Examination of Lubricating Oils

Need for Standardised Methods

MR. G. F. ROBERTSHAW, in a Paper on "Methods of Examination of Lubricating Oils," before the Institution of Petroleum Technologists on Monday, referred to the lack of uniformity in the methods in use for the examination of lubricants, and emphasised the necessity for a recognised standard system.

Physical properties were as important as chemical in the examination of lubricating oils, and the correct appreciation of the relation between physical and chemical tests was essential.

In the statement of specific gravity, unless otherwise specified, comparison was usually assumed to have been made with water at the same temperature. This assumption could not, however, be always accepted as correct, because this question appeared to be dealt with in a somewhat haphazard manner, and it was usually impossible to say, without further reference to those quoting the test, how comparison had been made. Specific gravity was often quoted at 20°C. or 15.5°C. without reference to the density of water taken for comparison, which varied considerably with temperature.

With regard to the flash-point, there appeared to be no definite rule for the performance of the open-flash test, and yet specifications often quoted this figure without reference to the method employed in performing the test. It was necessary that some form of apparatus and method of test should be standardised. Consideration should also be given to the standardisation of thermometers. Corrections were usually obtained with total immersion, whereas for flash-points the correction should be made for a small immersion of, say, one inch. The result given by the open-flash test usually differed considerably from the closed test, and the difference varied with different oils. The closed-flash test was usually performed in the Gray or the Pensky-Martens apparatus. These two forms of tester were similar in general outline, varying only in detail. The flash-point of an oil was an indication of its comparative safety in use, and might have no relation at all to its tendency to evaporate under conditions of heat. This tendency should be estimated by measuring the actual loss under definite conditions of time and temperature. So far as the author knew, there was at present no reliable method for determining the loss by evaporation which occurred on heating mineral oils, although this should be qualified by the statement that lubricating oils which only lost very small amounts on heating might be examined by Archbutt and Deeley's method with fair concordance.

Tagliabue Standard Tester

There were several methods in use for performing the cold test, and this led to difficulty when a test was returned without reference to the method used. The Tagliabue standard tester was the outcome of an effort to standardise the cold test. It consisted of a heat-isolated ice-chamber, surrounded by non-conducting walls, and having special arrangements for noting the effect on oil of the lowering temperatures. A method of comparing the properties of a number of oils under conditions of cold consisted in cooling down definite weights of oil in glass vessels of similar shape and size in the brine water of an ice plant. Here the temperature remained the same over long periods of time, and useful practical results might be very easily and quickly obtained. It should be carefully noted that an oil should not be used twice for the cold test, and that the time-factor and details of test performance were of great importance.

Although there were various methods suggested to estimate the liability of an oil to gum, the nitro-sulphuric acid test, mixing 5 grammes of an oil with 11 cubic cm. of acid, was said to give a good indication of this characteristic. The acid used for the test was obtained by saturating H_2SO_4 76°β containing a small proportion of HNO_3 with nitric oxide at 0°C.

There was great need for the standardisation of viscosity expression, as at present numerous different methods were being employed. Many appeals had been made from time to time that absolute viscosity or some convenient multiple thereof should be used as the standard method of expression. Such a method of expression afforded some quantitative idea of the power lost through defective lubrication. Absolute viscosity might be converted into lb. per square inch by the formula—

$$a = \frac{B}{69,000}$$

Where

a = lb. per square inch.

B = dynes per square centimetre.

Further, a temperature-absolute viscosity curve was useful in showing at what temperature an oil ceased to be an efficient lubricant. The suggestion that the viscosity unit be known as poise, with centipoise (0.01 poise) as the practical unit, had met with some favour. As this value approximated very nearly to the viscosity of water, the viscosity of an oil expressed in centipoises would be the same as its specific viscosity at the same temperature.

Friction Tests

There was no published method for the laboratory determination of oiliness, and, where convenient, chemical and physical tests should be supplemented by friction-tests. The design of mechanical testers varied according to the object in view during test. It might be desired to test different methods of lubricant application; differences in metal or alloy forming the bearings; behaviour of an oil under high-temperature or at ordinary temperatures under varying conditions of speed and load; durability; liability to oxidation, gumming or other changes during use.

Free organic acidity present in light-coloured oils might be estimated by direct titration in alcoholic solution. When the oil was dark in colour the free acid was washed out in neutral alcohol and titrated. Free mineral acid was of comparatively rare occurrence. Certain sulphonic acids which were liable to be present in lubricating oils which had been refined by a sulphuric acid treatment, were not decomposed easily, and required long boiling or treatment with superheated steam, where an estimation of the SO_3 content was required. It was usual to return acidity as oleic acid.

With regard to water, wherever possible direct methods of estimation such as direct heating in air-bath or over flame should be avoided, as these methods gave only very approximate results. Distillation with petrol or zylol gave results correct to a small percentage. With pure mineral oils, and for the estimation of small percentages of water, measurement of evolved acetylene or hydrogen might be used. Correction for the solubility of acetylene in an average mineral oil of about 1.1 times its volume had to be made. There was some doubt whether this method was applicable to mixtures containing fixed oil. In the lecturer's experiments difficulty had been found in obtaining complete concordance and the work was to be continued.

The liability of mineral oils to deposit tarry matters might be subjected to examination by solution in light petroleum solvents. Certain asphaltic substances were insoluble in petroleum ether, and might be examined after extraction and separation by this method. Where it was desired to use this test quantitatively, the time factor became important, as the quantity of insoluble matter obtained depended up to certain limits upon the time used in effecting solution, and allowing to stand.

Compounded Oils

The general principles of the estimation, separation and examination of the unsaponifiable and saponifiable portions of compounded oils were well understood. The use of high-boiling alcohol during saponification was useful for time-saving, and particularly so when cholesterol was present. Quick drying of an extracted oil was effected by the addition of benzene-alcohol mixture or acetone, either of which materially hastened the drying process. Oils which showed unnaturally high viscosity for their type were examined for compounds, such as aluminium soaps, which give a fictitious viscosity. Solidified oils consisted of mineral oils made solid or gelatinous by means of sodium, calcium or aluminium soaps. They were prepared either by dissolving soaps in mineral oils or by mixing fixed oils with mineral oil, and then saponifying either partly or completely. Lubricating greases consisted of semi-solid or solid emulsions containing fats, fatty oil, fatty acids, mineral and other unsaponifiable oils, rosin oil, wool grease, &c., the emulsification being effected by lime or caustic soda. Greases for special purposes contained graphite. No definite rule could be accepted for the examination of a lubricating grease, owing to the great variety of products used in manufacture. They should be examined for water, loss at 100°C., free alkali, free acid and filling materials.

The Chemistry of the Nile Sudd

Results of Recent Investigations

THE current issue of the *Journal* of the Society of Chemical Industry contains an interesting article on the Chemistry of the Nile Sudd, by Messrs. A. F. Joseph, D.Sc., F.I.C., and F. J. Martin, M.A., of the Wellcome Tropical Research Laboratories, Khartoum, from which the following extract is taken:—

"One of the chief obstacles to navigation in the upper reaches of the Nile and its tributaries is the blockage caused by masses of vegetable matter, locally termed 'Sudd,' an Arabic word meaning blockage or dam. This is composed of fixed and swimming plants, which vary from place to place. Of the many species that have been identified the most important are a papyrus (*Cyperus papyrus*), which grows to a considerable height, often exceeding 15 ft.; a grass (*Panicum pyramidale*), known locally as 'Um Soof,' a name meaning 'Mother of Wool,' given on account of the peculiar hairy character of its leaf sheath; and a convolvulus (*Ipomœa aquatica*). From the Zeraf mouth, 525 miles above Khartoum, to Shambe, a distance of 300 miles, a passage through the main channel is at times only kept clear with difficulty, whilst all the tributaries in this region are blocked for many miles. The vast area of the sudd is, of course, only known very roughly; experienced observers, however, estimate the denser portion at not less than 5,000 square miles—150 miles long and 30 to 40 miles wide—in extent.

Possible Utilisation of Sudd Material

"Various proposals have been made in recent years to utilise the material of the sudd as fuel. The amount available for this purpose has been estimated at 45 tons of air-dried papyrus per acre, from experiments carried out on the spot some years ago. Thus there is a store of 144 million tons in the area under consideration. The calorific value of dried papyrus has been found to be about 2,000 calories per gram, against 8,500 for bituminous coal; the 144 million tons may therefore be put thermally equivalent to 28 million tons of coal. In terms of energy the 144 million tons should, if burnt, be capable of furnishing 3.6 million horse-power continually, on the assumption that 10 lb. of the material is required for the generation of one horse-power hour against 1½ lb. to 2 lb. of coal. This amount of power is about three-fourths of the theoretical average power of the Niagara Falls, and is an enormous asset.

"Fuel is only one of many ways which have been suggested for the use of the sudd material; others, such as paper pulp, rope fibre, fertiliser (from the ash), and distillation products are amongst the possibilities of the future, and a detailed chemical examination of the subject is obviously desirable.

Proximate Analysis

"Two samples of papyrus were examined, the first (a) collected some years ago, and therefore subjected to a long period of air drying, and the second (b) in September, 1919, the analysis being carried out in October. The Um Soof was obtained about the same time as (b). Arrangements are being made to obtain other samples collected at different times of the year, as seasonal variations in the amount and composition of the ash might occur.

"As a result of the analysis the following determinations were made:—

Composition of the Entire Ash.				
Percentage.	Papyrus A Flower head.	Papyrus A stems.	Papyrus B stems.	Um Soof stems.
Total ash from air-dried material	11.6	4.66	6.00	8.56
Calculated on the ash				
K ₂ O	16.50	34.50	35.27	29.62
Na ₂ O	0.52	N.D.*	8.07	1.90
CaO—MgO	3.54	N.D.*	3.12	4.85
Fe ₂ O ₃ —MnO	3.04	3.80	1.44	1.71
SiO ₂	59.01	30.36	32.58	50.84
CO ₂	1.42	N.D.*	4.27	—
Cl	1.70	10.43	16.60	12.05
SO ₃	Trace	Trace	Trace	Trace
P ₂ O ₅	5.04	3.92	2.35	3.64
C	9.55	—	—	—
Deduct oxygen equivalent to chlorine	0.39	2.35	3.72	2.72
Total	99.93	—	99.98	101.89

* Not determined.

"The water-soluble portion had the following composition (calculated on the total ash): Total water-soluble salts 57.20 per cent., K₂O 29.72, Na₂O 5.59, SiO₂ 8.00, CO₂ 3.78, Cl 14.76 per cent.; total, 61.85; deduct oxygen equivalent to chlorine 3.32 per cent.=58.53 per cent. The following composition for the water-soluble portion would agree with the above figures: NaCl 10.53, KCl 17.61, K₂CO₃ 11.88, K₂SiO₃ 17.27 per cent.; total, 57.29 per cent. Such a product containing 39 per cent. of potassium (or over 50 per cent. as K₂O) might well be the basis of a very valuable fertiliser, and it is hoped to carry out some field experiments to test this next season. At the same time the whole ash (containing 35 per cent. K₂O) will be examined for manurial value.

Conclusions

"(a) Examination of papyrus and Um Soof—two of the most important constituents of the Nile sudd—indicates that these two plants may be of economic importance in paper pulp manufacture and as a source of potash.

"(b) The ash of papyrus stems contains more potash than that of Um Soof, but this is more than balanced by the higher proportion of ash yielded by Um Soof. Calculated on the dry plant, papyrus stems contain 2.1 and Um Soof stems 2.3 per cent. of potassium oxide.

"(c) Papyrus stems are readily acted on by hot water, more especially under a pressure of about four atmospheres. Treated in this way, practically all the mineral matter and most of the protein passes into solution, and the residue constitutes a satisfactory 'half stuff' for paper."

"In the course of the examination of the Nile sudd it was necessary to determine the total amount of sodium in papyrus ash. The sodium was brought into solution by fusion with potassium carbonate and extracting with water, the solution then containing potassium in excess, sodium, phosphates and silica. After removal of the latter in the usual way, the phosphate was precipitated by ferric chloride and ammonium acetate, the filtrate evaporated to dryness, and the residue ignited to expel ammonium salts. The potassium was then separated as perchlorate and the sodium estimated directly in the filtrate, as any method of determining it by difference appeared to be subject to too great an error, owing to the relatively large amount of potassium present.

"The process was carried out as follows: After the removal of the silica the solution was evaporated two or three times with a slight excess of perchloric acid and the potassium perchlorate separated in the usual way. The filtrate and the alcohol washings, containing the sodium and excess of perchloric acid, were evaporated in a beaker nearly to dryness, and then transferred to a porcelain crucible, the evaporation being finished on an electrically heated hot plate. The residue was treated with sulphuric acid and the sodium finally weighed as sulphate. A number of estimations in this manner were made without mishap. On the last occasion, however, a violent explosion occurred during the evaporation on the hot plate, when only 1 or 2 c.c. of liquid remained in the crucible. The force of the explosion produced a shallow cavity in the heavy top of the iron hot plate over ½ in. deep, the crucible being completely shattered and splinters driven with considerable force to a distance of 30 or 40 ft. Some of these splinters actually punctured bottles, flasks, and windows several yards away with holes about 1/10 in. diameter. Vessels close to the explosion were, of course, completely shattered.

"The only cause we can suggest for this explosion is that some organic matter derived from the alcohol was not removed in the first part of the evaporation, and remained until the perchloric acid was concentrated. We have for the time being discontinued the use of this method."

Recent Wills

Mr. G. Courtauld, a director of Courtauld & Co., Ltd.	£2,146,695
Mr. G. Ainsworth, of Consett Hall, Consett, Durham, late general manager of the Consett Iron Co., Ltd., at one time chemist and druggist at Dow-lais Iron Co.	£98,875
Mr. D. Hey, of Hebden Bridge, Chemist	£12,778
Mr. J. Webster, of Buckie, Banff, Chemist	£7,309

American Notes

Ramsay Memorial Fund

The United States Committee on the Ramsay Memorial Fund has transmitted £3,500 which it has collected; £263 have been sent direct by contributors; and approximately £100 remain in the hands of the treasurer, W. J. Matheson. Professor Baskerville, the chairman, hopes that the total American contribution, £3,863, may be raised to £4,000, after which the American subscriptions may be closed. The total fund now amounts to £51,274.

Chemical Society Meeting at St. Louis

According to *Drug and Chemical Markets*, the coming meeting of the American Chemical Society at St. Louis is likely to prove of far greater interest than any meeting held by the Society in recent years. It comes at a time when the chemist is being called upon insistently to find substitutes for products that have become too costly owing to the war, and to devise means for obtaining from new sources certain raw materials not heretofore produced here. The American chemist's record of achievement is a long one already, and the nation is indebted to him for many new industries based upon his discoveries.

The Leather Chemists' Section will point the practical way to make shoes from the skins of sharks and overcome the high cost of leather. The section in sugar chemistry will present the latest discoveries which will enable the world to increase its supply of sugar, and an American-made saccharimeter, an instrument for testing sugar, will be shown. In the Dyes Section there will be presented some of the problems which the American chemist has solved since German supplies were cut off. The progress so far made will be a surprise to many who have not had the opportunity to learn what is being done.

The wide field covered by the chemist is only faintly outlined by the programme of the Papers to be read before the nine divisions and three sections of the Society, but the names indicate the ramifications of the profession which covers agricultural and food chemistry, biological chemistry, fertiliser chemistry, industrial and engineering chemistry, organic chemistry, pharmaceutical chemistry, physical and inorganic chemistry, rubber chemistry and water, sewage and sanitation chemistry, in addition to dyes, leather and sugar.

The founders of the American Chemical Society and the distinguished men who have expanded its field of operations from year to year deserve great credit for the part the chemist has taken in developing and perfecting American industries and for the assistance given to its 15,000 to 16,000 members through its various branches, its system of lectures and its technical publications.

National Foreign Trade Council Report

The Committee on Foreign Chemical Trade of the American Chemical Society calls attention to a recent publication of the National Foreign Trade Council embodying the results achieved by the conference on the "Standardisation of Export Quotations and American Export Practice," which was participated in by the nine great foreign trade organisations of the United States. The definitions and recommendations of this conference tend materially to clarify a situation which by its confusion has done much to harm the best interests of American foreign trade.

Fellowship at Washington University

The Monsanto Chemical Co. has established in Washington University, St. Louis, Mo., a \$500 fellowship in chemistry for the academic year 1920-21. The holder is to be designated by the Chancellor of the University and Professor L. McMaster, and shall be pledged to devote himself exclusively to study and research in chemistry.

Obituary

The death of Dr. Leonard N. Liddle, a senior Industrial Fellow of the Mellon Institute of Industrial Research, is a great loss to the chemical profession in America. Devoting most of his life to research, he spent his time while at the Mellon Institute in conducting techno-chemical investigations on vegetable and animal oils, fats, soaps and perfumes. His researches on the refining and hydrogenation of vegetable oils (1913-16) were conspicuously valuable from an industrial standpoint, and his latter work on soaps (1917) and perfumes (1918-1920) showed consistently high research ability and also resulted in the development of several processes of commercial importance. At the time of his death he was serving as presi-

dent of the Robert Kennedy Duncan Club, the organisation of the Industrial Fellows of the Institute.

DR. FRANCIS C. PHILLIPS, whose death is announced at the age of 69, was a well-known figure among American chemists. In 1875 he left Delaware College, Wilmington, Del., where he was in charge of the Chemistry Department, to go to the University of Pittsburgh, where he was professor of chemistry for 40 years.

THE death of Dr. D. S. Pratt, at the age of 35, cut short a career of great promise. He graduated at Cornell University in 1908, and remained there as a Fellow in Chemistry until 1911, when he received the degree of Ph.D. He then joined the staff of the Bureau of Chemistry in Washington, as assistant chemist, but remained there only a short time, being soon selected as Chief of the Organic Division of the Bureau of Science in Manila, P.I. His chemico-economic studies in the Philippines were varied and valued, and he also acted as a member of the Pure Food and Drug Board. In 1914 he returned to the States to accept a professorship of chemistry at the University of Pittsburgh, and he successfully occupied that chair and the headship of the organic department of the School of Chemistry for three years—until he was made an Assistant Director of the Mellon Institute of Industrial Research. On January 1 after three years' service, he resigned his post at the Institute and was arranging to enter consulting chemical practice in St. Louis, Mo., at the time of his fatal illness.

Chemical Workers' Long Service

Presentations at Brunner Mond & Co.'s Works.

ON Monday and Tuesday the first two of a series of interesting ceremonies were held at the Lostock and Winnington works of Messrs. Brunner, Mond, & Co., where men with a service of 25 years and upwards were entertained and presented with gold and silver watches and medals. Similar entertainments are to be held at Winnington and also at Sandbach and Middlewich until the "roll-call" is complete.

The figures which were quoted by Mr. Roscoe Brunner (chairman of the directors) are believed to constitute a record in British industry. Out of 6,929 employees at the various works of the firm 1,311 have put in over 25 years' service, the percentages at the three principal works being 21.6 at Winnington, 22.6 at Sandbach, and 15.4 at Lostock. Gold watches and medals were given to those who had completed 35 years or more, and at Winnington there were 148 claimants, at Sandbach 36, and at Lostock four. At Winnington, where 4,301 men are employed, no fewer than 1,032 have served over 25 years, eight have worked 40 years, nine 41, two 42, and two the maximum of 46. Sandbach has 109 watch winners, Lostock 98, and Middlewich 60.

The Chairman, in making the presentations, mentioned that the works at Winnington were started by cutting the first sod in February, 1873, and it was a proud record for the men and for the firm that 21.6 of their employees had been continuously in the service of the Company for more than 25 years. It showed, he said, that the relations between the Company and those who had served it had been of the most cordial description. He believed that any concern which carried on in that spirit was bound to succeed. The Company owed an enormous lot to those who had stuck by it all those years, and his only regret was that it had grown so big that it was impossible for the directors, as was formerly the case, to know every one of the workers by name. (Applause.)

Sir John Jarmay, Mr. J. I. Watts, and Mr. J. J. Harper were three of seven resident directors who are to receive gold watches for over 35 years' service, and it was explained by the chairman that it is intended to make similar awards annually to all men as they qualify by length of service, the silver watch men being eligible to win gold watches.

Mr. Mat. Brown, a 46-year man, described the difficulties which were encountered in the early days of the concern, and Mr. Ernest Starkey and Mr. E. Dean, in voicing thanks to the directors, referred to the ideal conditions of labour, to the common sense which had weathered storms and prevented strikes, to the concession of a week's holiday with a fortnight's pay for all the workers, to gifts of recreation grounds, &c., which had cemented the good feeling.

At the call of one of the employees a silent tribute was paid to the founders of the firm—the late Sir John Brunner and Dr. Mond.

Chemical Matters in Parliament

Government Laboratory Assistants

MR. ALFRED DAVIES (Clitheroe) asked the Financial Secretary to the Treasury (House of Commons, April 15) whether there were certain temporary chemical assistants in the Department of the Government Chemist over 30 years of age whose dismissal was pending under the existing regulations; whether the male temporary chemical assistants in question were refused permission to join the Army, had discharged their duties satisfactorily for many years, and were retained up to and beyond the age of 30 in the Department during the War; whether such assistants were debarred from obtaining the new scale of pay recently granted to temporary chemical assistants as a consequence of the enforcement of the age-limit regulation; whether the volume of work in the Department necessitated the engagement of several new temporary chemical assistants in the early part of this year, notwithstanding the formal and informal notices of dismissal served on the older trained temporary chemical assistants in January last; and whether, in the above circumstances, he would assent to the retention of the older temporary chemical assistants until the matter could be discussed by the Whitley Council?

Mr. Baldwin: There are at present two of the Temporary Chemical Assistants referred to over the age of 30, the age at which they are due to retire under the terms of their engagement. The senior of these received informal notice over 12 months ago and is now under definite notice to leave. He was classed as B. 1 and owing to the exigencies of the times, was retained in the Government laboratory to perform such routine work as could be entrusted to him. He is paid on the new scale recently granted to his class. New temporary chemical assistants have been appointed this year, but only to fill vacancies which have occurred. I do not consider that it would be in the interest of the public service to assent to the proposal in the last part of the question.

Mr. R. Richardson asked the Financial Secretary to the Treasury (House of Commons, April 21) whether, under the regulations governing the appointment of temporary chemical assistants in the Department of the Government Chemist, the senior trained and fully qualified assistants over 30 are compelled to retire first, notwithstanding the retention in the Department of certain qualified and less trained temporary women chemical assistants, who were engaged in the Department in the first instance owing to the exigencies of the War, and also notwithstanding the continued engagement of new women temporary chemical assistants in the early part of this year?

Mr. Baldwin: The answer to the question is in the negative. There is no regulation governing the order in which temporary chemical assistants in the Department of the Government Chemist, who have passed the age of 30, shall retire.

Home-Grown Sugar, Ltd.

SIR A. BOSCAWEN, in reply to Mr. Macquisten (House of Commons, April 15), who asked if he were aware that Home-Grown Sugar, Ltd., in which the Government had taken half of the issue of £500,000, was about to place its contract for sugar factory machinery with the French firm of Compagnie Fivesbille, of Paris, instead of with British firms whose capacity for producing beet-sugar machinery was equal to the French firms; and whether he would instruct the Government's financial representative on the Board of Home-Grown Sugar, Ltd., to exercise his power of veto upon such contract, said that he had ascertained that the contract was placed after consideration of competitive tenders, of which the French firm's was the lowest. The board of the company was desirous of obtaining the special knowledge of the French manufacturers which was not available in this country, the principal competitors in the United Kingdom not having had experience of beet factories. In these circumstances the Ministry was not prepared to interfere with the action taken by the company.

Mr. Macquisten: At least two-thirds of the machinery that is used in beet sugar making is identical with cane-sugar machinery and the major portion of it can therefore be made in this country. There are firms in this country who have imported special experts in this particular branch of machinery. France has 120 factories to repair which were destroyed by the Germans, and her hands will be full for a long time to come, and what is the use of encouraging one home industry at the expense of another? Will the right hon. Gentleman

receive a representation from a firm or firms capable of making the machinery?

Sir A. Boscawen: I shall be quite willing to receive a deputation or a representation, but this is a new industry in this country and we wish to have the benefit of French experts.

Mr. Macquisten: The firms in question have the best French experts in their employment for this purpose.

In reply to a further question by Mr. Macquisten (House of Commons, April 21), Sir A. Boscawen said the order to the French firm was given mainly on account of their special experience of beet sugar factories which the competing British firms did not possess. The difference in price was not the primary consideration, but the estimates were received before the recent rise in the rate of exchange took place.

Anglo-Persian Oil Co.

Commander Viscount Curzon asked the Under-Secretary of State for Foreign Affairs (House of Commons, April 20) whether he would, in the public interest, ascertain and state the price at which the Anglo-Persian Oil Co., in which the British Government had a controlling interest, was now selling its petrol to the Royal Dutch Shell group; and whether that price varied in accordance with the market price of petrol or was a fixed price during the term of the contract between the company and the Shell group?

Mr. Kellaway: As already stated, it is regretted that the price ruling under this contract cannot be stated. It has previously been made clear that this particular contract was concluded before the Government acquired an interest in the company.

Viscount Curzon: Are we to understand that the Government do not know the price or that they do not like to state it?

Mr. Kellaway: I believe the price was given before the Profiteering Committee.

Sir J. D. Rees: Has the Anglo-Persian Oil Co. any control over the price in this country?

Mr. Kellaway: I think not. A contract has been in existence for some years.

The Oil Industry

Sir J. D. REES asked the Prime Minister (House of Commons, April 19) if he could state which Minister now performed, in respect of the oil industry and of questions relating to oil, the functions recently discharged by the Chief Secretary to the Lord Lieutenant of Ireland?

Mr. Bonar Law: It is intended that the duties in this respect performed by the Chief Secretary while he was head of the Department of Overseas Trade will be undertaken by his successor.

Benzol from Coke Ovens

Sir R. Horne, in reply to Captain Moreing (House of Commons, April 19), stated that the total production of refined benzol at coke ovens and gas works in 1919 was approximately 20,000,000 gallons.

Petrol

Viscount Curzon asked the President of the Board of Trade (House of Commons, April 19) what company was referred to in the Report of the Sub-Committee on motor fuel as selling its output of petrol at £10. 10s. per ton, 8s. 4d. per gallon; and how much of the said company's petrol was imported into this country?

Sir R. Horne: I am unable to supply the required information. Information and documents required to be given to a Committee or Tribunal under the Profiteering Act must be treated as confidential unless the person giving or producing the same otherwise agrees. I have no information concerning the amount of petrol imported into the country by the company referred to in the question.

Chemical Engineering at Nebraska University

THE new courses in practical chemistry opened last September by the Department of Chemistry of the University of Nebraska are proving very successful. For some years this department was not in a position to offer technological chemical courses, because of lack of facilities. Now the department is housed in a well equipped new laboratory and the chairman of the chemistry faculty, Dr. F. W. Upson, has arranged for courses devoted to chemical engineering subjects. The department has also arranged a course in "Oil and Gas," which is primarily for geologists. This work is in charge of Associate Professor C. J. Frankforter.

From Week to Week

A report on the fuel problem signed by the Director, Sir George Beilby, was issued this week by the FUEL RESEARCH BOARD. (Stationery Office, 1s. 6d. net.) It covers the work of the two years 1918 and 1919.

BELGIAN MINISTERIAL DECREES forbid the importation of sulphuric ether, and the exportation of chemical manures, carbonate of soda (crystallised or calcined), phosphate (natural) and distillation products, *i.e.*, heavy tar oils, benzol, toluene, xylene, naphthalene, anthracene, cresote, phenic acid or phenol (crude), cresol (crude), tar and pitch, except under licence.

The chemical department of the LEEDS CENTRAL TECHNICAL SCHOOL has recently obtained from the Pharmaceutical Society recognition as an institution qualified to prepare candidates for the Society's examinations. The Society's examination has been recently held, and the three students of the school, who entered for the examination have been successful.

At a meeting of the University Court of the University of Edinburgh on Tuesday, Principal Sir Alfred Ewing reported that His Majesty the King had graciously consented to lay in July next the foundation-stone of the new CHEMICAL LABORATORIES AT CRAIGMILLAR, at present in course of erection, the first building on the University's new site of 115 acres, on the possession of which it entered at Martinmas.

A report on TUNISIAN PHOSPHATES, together with the principal producers and exporters, may be consulted on application to the Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W.1. Tunis occupies second place after the United States of America as a producer of phosphates. Exploitation commenced in 1899, and the production in 1913 was over 2 million tons, valued at 45½ million francs.

MR. B. MAISEL, managing director of Maisel's Petroleum Trust, Ltd., and the Romana Petroleum Co., Ltd., has left London for Roumania in connection with the active development and reorganisation of these companies' petroleum undertakings in that country, and will also visit Poland on business connected with the Joanna Petroleum Gesellschaft's Galician oil properties, to which he has been urgently summoned to attend.

The subject for discussion at the monthly meeting of the CHEMICAL INDUSTRY CLUB was "What is a Fair Minimum Wage for Chemists?" The discussion should have been opened by Mr. T. W. Stuart, general technical manager of the United Alkali Co., but, in his unavoidable absence, his place was taken by Mr. Charlier, president of the National Association of Industrial Chemists. An interesting discussion developed in which several members took part.

MR. ARTHUR H. HIORNS, the founder of the Birmingham Metallurgical Society, and for 40 years head of the Metallurgical Department of the Birmingham Technical School, died on Saturday, April 17, at Water Orton. Mr. Hiorns wrote a large number of books and papers on metallurgical subjects, and his services were often sought by the technical societies. Some of his works have been translated into many languages, and are recognised as standard works on metallurgy.

At a recent meeting of the Senate of the Queen's University of Belfast, a letter was received from Sir Charles Brett, intimating that Mr. F. A. Heron, of Holywood, proposes to give £5,000 to provide the necessary equipment for the TEACHING OF PHYSICAL CHEMISTRY, and a further £1,000 to assist in providing the necessary accommodation for the equipment. In moving the thanks of the Senate to the donor, the vice-Chancellor said that the chemical laboratories and lecture rooms were at present much over-crowded and the staff over-worked.

The Commonwealth Government has offered a REWARD OF £10,000, subject to certain conditions, for the discovery in Australia of petroleum oil in commercial quantities. Amongst other conditions it is stipulated that the Minister for Home and Territories and the Minister for Mines for the State, or either of them, may authorise any officer to visit the bore and inspect all operations and records, and the payment of the reward shall not be authorised unless it is proved that oil to

the extent of 50,000 gallons has been obtained, and that the bore is still flowing freely and producing oil in commercial quantities.

FINES amounting to £40, with an allowance of £40 for costs, or a total of £80, were imposed on T. H. Walton, manufacturing chemist, Upper Road, Batley Carr, last week, in respect of the selling and trade description of saccharine tablets which, it was alleged, contained only about two-thirds of the guaranteed amount of saccharin. It was stated for the defence that the tablets had been made in large quantities, and with great care, in three grades, by Mrs. Walton, who was a qualified chemist, and the only possible explanation of the present case was that by mistake in the absence of Mrs. Walton, the girls had packed ⅓ grain tablets in ⅓ grain boxes.

In the third annual REPORT OF THE CONJOINT BOARD OF Scientific Societies it is stated that during the year there was a danger that supplies of casein and glue would fall short and that in consequence aeroplane manufacture would suffer. The Board came to an arrangement with the Air Group of the Ministry of Munitions, and carried out a research into the nature, functions, and manufacture of adhesives. This resulted in the discovery of two new adhesives, one possessing very remarkable properties, the other prepared from a waste product of which there was a large supply in the country throughout the war. In addition to this, Dr. Schryver and his colleagues devised improvements in the manufacture of casein which effect a considerable saving in material and an improvement in its quality.

MR. THORP WHITAKER, of the Bradford Dyers' Association, has been appointed an officer of the Order of the British Empire for service rendered on work connected with the War. As adviser to the Dyes Department of the Board of Trade, he undertook, together with others, the compilation and classification of the imports of German dyes into the United Kingdom for the year 1913, which has served as a guide to British makers of the essential dyes required for the textile trade generally. When the Trades and Licensing Committee was formed by the Government in 1918 to determine what colours and intermediates should be licensed to be imported into this country after the War, and to advise as to the manufacture of which dyes should be specially encouraged, Mr. Whitaker was one of four specialists appointed on the sub-committee to carry out the Act, and was one of the Commission lately sent by the Government to enquire into the present position of stocks of dyes in Germany, and the outlook for the immediate future of the German coal-tar colour industry.

Obituary

PROFESSOR A. K. HUNTINGTON.—The death took place suddenly on Saturday, April 17, of Professor Alfred Kirby Huntington, A.R.S.M., M.Inst.M.M., F.I.C., Professor of Metallurgy at King's College University since 1879. Professor Huntington lived in Buckingham Street, Strand, and his death was quite unexpected. It is understood that an inquest will be held. His appointment terminated in October last and his colleagues state that his severance from active work had had marked effects upon him. During the war Professor Huntington was engaged in highly specialised work in connection with high explosives for the Admiralty. He had made a number of benefactions to the University of London, particularly in books to the library, and had given machinery and apparatus to other institutions. Outside his professorial work Professor Huntington was keenly interested in aviation. Before heavier-than-air flying he was an enthusiastic balloonist and as far back as 1905 was a member of the Aero Club.

DR. R. MESSEL.—We regret to announce the death on Tuesday last of Dr. Rudolph Messel, F.R.S., past president and for many years foreign secretary of the Society of Chemical Industry. Dr. Messel had been in failing health for some time, but retained in a remarkable degree the energy and technical insight which had characterised his life's work. His researches with Winkler and others into the manufacture of "oleum" are classical and were developed commercially under his guidance. A staunch supporter of the Society of Chemical Industry, his influence was a considerable factor in its development, while his genial personality will be greatly missed by his large circle of friends, and at the Savage Club, of which he was a prominent member. Dr. Messel was in his 73rd year.

References to Current Literature

British

ANALYSIS. Estimation of the nitro group in aromatic organic compounds. T. Callan, J. A. R. Henderson and N. Stafford. *J. Soc. Chem. Ind.*, April 15, 86-88T.

Note on an explosion during the separation of potassium by the perchlorate method. A. F. Joseph and F. J. Martin. *J. Soc. Chem. Ind.*, April 15, 94T.

COAL. A new characteristic for coal. The agglutinating power curve. F. S. Sinnatt and A. Grounds. *J. Soc. Chem. Ind.*, April 15, 83-86T.

ELECTROLYSIS. Alternating-current electrolysis. S. Marsh. *Roy. Soc. Proc. (A)*, April 1, 124-144. Experiments with gold, platinum and nickel electrodes are described.

FINGER-PRINTS. The detection of finger-prints on documents. C. A. Mitchell. *Analyst*, April, 122-129.

GAS. Operating a by-product gas-producer plant. W. H. Patchell. *Engineering*, April 16, 529-531. A Paper read before the Institution of Electrical Engineers on March 11.

Gas in relation to increased output and national economy. H. M. Thornton. *J. Roy. Soc. Arts*, April 16, 346-366. A fully illustrated Paper.

Standardised methods of sampling and testing spent oxide. *Gas World*, April 17, 320. Methods which have been approved by the National Gas Council are described.

NILE SUDD. A preliminary account of the chemistry of the Nile sudd. A. Joseph and F. J. Martin. *J. Soc. Chem. Ind.*, April 15, 91-94T. The possibilities of utilising the material are discussed.

ORGANISATION. Control of plant output. *J. Soc. Chem. Ind.*, April 15, 125-127R. Methods of effecting control are explained with the aid of charts.

PHOTOMICROGRAPHY. Photomicrography with simple apparatus. T. J. Ward. *Analyst*, April, 130-133.

RESEARCH. Research, its place and function in an educational system. H. H. Hodgson. *J. Soc. Dyers & Col.*, April, 101-107.

SULPHUR. The viscosity of sulphur. C. C. Farr and D. B. Macleod. *Roy. Soc. Proc. (A)*, April 1, 80-98.

VISCOSIMETRY. A workshop viscosity meter. *Engineering*, April 16, 509. An illustrated description of the viscosimeter devised by A. G. M. Mitchell.

French

AMMONIA. Contribution to the study of the direct catalytic synthesis of ammonia under pressure. M. Guichard, Vavon, Cornec, Cantagrel, Stevenson, Apard and Bourdiol. *Bull. Soc. d'Encour.*, January-February, 71-102. A valuable series of experiments is recorded.

ANALYSIS. Determinations of hypodorous acid in acid solution. V. Cofman. *Bull. Soc. Chem.*, March 5-20, 234-239.

CEMENT. The manufacturing of artificial Portland cement. J. Hendrickx. *Le Ciment*, January, February and March, 3-9, 42-48, 86-87.

GAS REACTIONS. The action of very finely divided gases. C. Zenghelis. *Comptes rend.*, April 12, 883-886. Interesting experiments with hydrogen and other gases using a permeable membrane are recorded.

PETROLEUM. The petroleum fields of Alsace. P. de Chamberrier. *Bull. Soc. d'Encour.*, January-February, 45-70.

TAR. Modern developments of the coal tar industry. C. Berthelot. *Rev. Met.*, February, 63-92. This is the first instalment of a Paper on modern tar works practice.

United States

ALCOHOLS. The future of industrial alcohols. B. R. Tunison. *J. Ind. Eng. Chem.*, April, 370-376.

ALUMINIUM. Aluminium rolling mill practice IV. R. J. Anderson and M. B. Anderson. *Chem. & Met. Eng.*, April 7, 647-650. (See also *CHEMICAL AGE*, 1920, 383, 411.)

AMMONIA. The production of ammonia and formates from cyanides, ferrocyanides and cyanised briquets. G. W. Heise and H. E. Foote. *J. Ind. Eng. Chem.*, April, 331-336.

The preparation of nitrogen and hydrogen mixture by decomposition of ammonia. R. O. E. Davis and L. B. Olmsted. *J. Ind. Eng. Chem.*, April, 316-317.

ANALYSIS. Use of cupferron in quantitative analysis. G. E. F. Lundell and H. B. Knowles. *J. Ind. Eng. Chem.*, April 344-350.

A rapid and accurate method for determining nitrogen in nitrate of soda by the modified Devarda method and the use of the Davisson scrubber bulb. C. A. Butt. *J. Ind. Eng. Chem.*, April 352-354.

Determination of iodide and bromide in mineral waters and brines. W. F. Baughmann and W. W. Skinner. *J. Ind. Eng. Chem.*, April, 358.

Automatic methods of gas analysis depending upon thermal conductivity. E. R. Weaver, P. E. Palmer, H. W. Frantz, P. G. Ledig and S. F. Pickering. *J. Ind. Eng. Chem.*, April, 359-366.

Apparatus for the determination of melting points. L. M. Dennis. *J. Ind. Eng. Chem.*, April, 366-368.

New forms of combustion apparatus for use in gas analysis. E. R. Weaver and P. G. Ledig. *J. Ind. Eng. Chem.*, April, 368-370.

EXPLOSIVES. The preparations of hexanitrodiphenylamine and its use as a booster for shell charges. J. Marshall. *J. Ind. Eng. Chem.*, April, 336-340.

Nitrocellulose from wood pulp. R. G. Woodbridge. *J. Ind. Eng. Chem.*, April, 380-384.

Notes on sheet and plate glass manufacture. E. H. Bostock. *J. Amer. Ceram. Soc.*, January, 35-39.

GLAZES. Use of substitutes for tin oxide in glazes. R. H. Minton. *J. Amer. Ceram. Soc.*, January, 6-12.

Some data on the development of terra-cotta glazes. E. C. Hill. *J. Amer. Ceram. Soc.*, January, 13-25.

GLUE. Testing the strength of glue jellies. W. H. Low. *J. Ind. Eng. Chem.*, April, 355-356.

Determination of the tensile strength of glue. G. Hopp. *J. Ind. Eng. Chem.*, April, 356-358.

GLYCOLS. Ethylene and propylene chlorhydrins and glycols from oil gas. B. T. Brooks. *Chem. & Met. Eng.*, April 7, 629-633.

LAMPBLACK. Carbon black—its properties and uses. G. St. J. Perrott and R. Thiessen. *J. Ind. Eng. Chem.*, April, 324-331. Tests for differentiating various kinds of carbon black are suggested.

REFRACTORIES. The Malinite process for the production of sillimanite refractories. A. Malinovsky. *J. Amer. Ceram. Soc.*, January, 40-68. The production of neutral, highly refractory material is described.

Silicious sagger mixtures. M. R. Hornung. *J. Amer. Ceram. Soc.*, January, 69-76.

ZINC. Methods for analytical control of electrolytic zinc. H. F. Bradley. *Chem. & Met. Eng.*, April 7, 651-654.

German

ANALYSIS. Critical study of processes for the estimation of phosphorus in iron, steel, ores and slags. H. Kinder. *Stahl u. Eisen*, March 18-25, 381-387.

An algebraic method for detecting adulteration of ceresin with paraffin. H. Smelkus. *Chem. Zeit.*, April 8 and 13, 270-275, 286-289.

A simple apparatus for preventing over-titration. R. Orthner. *Chem. Zeit.*, April 10, 282.

Rotating stand for incineration with two flames. G. Lockemann. *Chem. Zeit.*, April 10, 283.

Estimation of mineral constituents in organic materials, especially those containing phosphorus. J. Grossfeld. *Chem. Zeit.*, April 13, 285-286.

CYANAMIDE. Inorganic impurities of calcium cyanamide. J. Baumann. *Chem. Zeit.*, April 8, 275-276.

GAS. The economics of gas-producer practice with recovery of low temperature tar and ammonium sulphate. E. Roser. *Stahl u. Eisen*, March 18-25, 387-395. Conclusion of an article already noted (*CHEM. AGE*, 1920, 411).

MINERAL OILS. Some experiences on the working up of waste products of the mineral oil industry. E. W. Albrecht. *Chem. Zeit.*, April 10, 282.

NOMENCLATURE. The nomenclature of inorganic compounds. A. Rosenheim. *Z. angew. Chem.*, April 2, 78-79. A Stock, *ibid.*, 79-80.

Patent Literature

We publish each week a list of selected complete specifications accepted as and when they are actually printed and on sale. In addition, we give abstracts within a week of the specifications being obtainable. Readers can thus decide what specifications are of sufficient interest to warrant purchase, the only way of obtaining complete information. A list of International Convention specifications open to inspection before acceptance is added, and abstracts are given as soon as possible.

Abstracts of Complete Specifications

- 16,530/1914. PORTLAND CEMENT, MANUFACTURE OF. W. J. Mellersh-Jackson, London. (From F. Krupp, Akt.-Ges. Grusonwerk, Magdeburg-Buckau, Germany.) Date of application, July 10, 1914.

The process is for the manufacture of Portland cement from natural rocks containing alkali, and the recovery of the volatile alkali salts. The rock, such as feldspar, is mixed with lime, limestone or the like, and a contact mass of salt or salts, such that when the mixture is calcined and burned at ordinary working temperature, the base or bases of the contact mass will be incorporated in the cement clinker, and the acid from the salt will be distilled off in combination with the whole of the alkali. Suitable contact salts are calcium sulphate, calcium chloride, magnesium sulphate, ferrous sulphate or aluminium sulphate. A suitable salt may be obtained by adding acid to a Portland cement mixture. Finely divided ferric oxide may also be added to act as a catalysing agent and facilitate the reaction; but such addition is unnecessary if ferrous sulphate is employed as the contact salt. The volatilised alkali salts are recovered from the gases of the cement kiln by any known method.

- 109,271. ROASTING ORES. F. Krupp Akt.-Ges. Grusonwerk, Magdeburg, Buckau, Germany. (Assignees of W. Kauffmann, Dessau, Germany.) International Convention date (Germany), September 15, 1915.

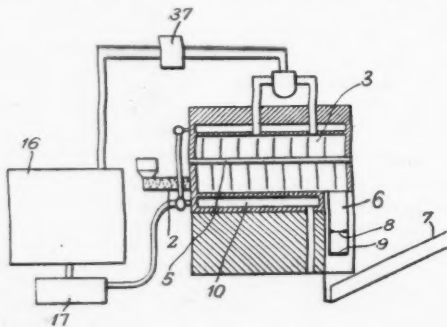
A horizontal rotary furnace is provided with air supply openings around its circumference and distributed along its length. The air supply through each opening during the roasting of the ore—e.g., iron pyrites—is regulated in accordance with the combustion taking place in the neighbourhood of the opening.

- 115,439. PLASTIC COMPOSITIONS FROM CASEIN. R. Weiss, 6, Holtstrasse, Hamburg, Germany. International Convention date (Germany), April 28, 1917.

Casein is kneaded in a machine under heat and pressure with sulphonated fatty acids, such as Turkey red oils obtained by the action of sulphuric acid on olive or castor oil. The product is a tough, horny, transparent material.

- 123,738. COAL, DISTILLATION OF. C. H. Smith, Short Hills, N.J., U.S.A. International Convention date (U.S.A.), February 16, 1918.

Coal having a high volatile content is finely divided and fed by a screw conveyor, 2, into a horizontal retort, 3, along which



it is fed by paddles on two parallel longitudinal shafts, 5. Distillation is effected at 800°F. to 950°F. by heating the retort by means of combustible gases supplied to the combustion chambers 10, and the coke residue, which is porous and free from tar, is delivered from the further end of the retort into a conduit, 6, having two discharge gates, 8 and 9. The coke then passes into a conveyor, 7, which transfers it to the top

of a gas producer. Producer gas or water gas and ammonia are formed in the producer at a temperature of 1,500°F. to 1,800°F., and these gases are separately collected. The gases and tar from the retort pass through an exhauster, 37, to a cooler and purifier, 16, which retains the tar. The residual gas passes to a holder, 17, and part may be used for heating the retort.

- 140,112. PEAT, PROCESS FOR DEHYDRATING. C. Bouillon, 21, Rue de la Rochefoucauld, Paris. Application date, January 17, 1918.

The water contained in the cellular structure of peat is removed and the peat partly disintegrated by treating it with a cold and very dilute solution of any salt which is capable of coagulating blood. The peat is preferably finely divided and drained, and is treated with a 1 per cent. solution of calcium chloride, or, alternatively, perchloride of lime. Reference is directed in pursuance of Section 7 Sub-section 4 of the Patents and Designs Act, 1907, to Specifications 9,911 of 1907, 3,367 of 1912 and 25,385 of 1912.

- 140,114. METALLIC CHLORIDES, PREPARATION OF ANHYDROUS. P. L. Hulin, 6, Rue Félix Poulat, Grenoble (Isère), France. Application date, May 7, 1918. Addition to 128,327.

Specification 128,327 (see THE CHEMICAL AGE, Vol. I., page 174) describes the process of dehydrating magnesium chloride by treating it with hot synthetic hydrochloric acid gas. In this addition the process is extended to the dehydration of all chlorides which are decomposed when simply heated, such as the chlorides of chromium, iron, cerium and the like. The combustion of hydrogen and chlorine may take place in the chamber containing the chloride or adjacent to the chamber, so that the heat of combustion produces the dehydration of the chloride. The temperature may be regulated by adding an excess of chlorine, or by adding gaseous hydrochloric acid to the chlorine and/or the hydrogen. It is known that a considerable proportion of the water of hydration may be removed from such chlorides without decomposition by heating in a vacuum, and this process may be adopted as a preliminary to the dehydration process described above.

- 140,115. ETHYL ALCOHOL AND ETHYL ACETATE, PROCESS FOR THE SYNTHETIC MANUFACTURE OF. P. V. H. Pascal, 35, Rue Waldeck Rousseau, Angoulême (Charente), France. International Convention date (France), April 3, 1917.

Ethyl alcohol and ethyl acetate are prepared by the hydrogenation of aldehyde or paraldehyde produced from acetylene. The hydrogenation is effected by electrolysis of the aldehyde or paraldehyde in an acid medium, the aldehyde being obtained from acetylene either previously by any process or in the electrolytic apparatus concurrently with the hydrogenation. It is preferred to use sulphuric acid of 5 to 10 per cent. strength, but other acid electrolytes may also be used. The aldehyde or paraldehyde is added to the cathode chamber in two stages, first up to 10 per cent. and then up to 30 per cent. The temperature is kept at about 40°C., which is maintained by the heat of hydrogenation. A porous diaphragm is used in the electrolytic cell to prevent the diffusion of the alcohol and the aldehyde towards the anode. The cathode may be of pure lead or lead-antimony alloy, which may be lead-plated or amalgamated; mercury may, alternatively, be used as the cathode. The anode may be an inert material, such as platinum, lead, iron oxide, &c., and the current should be 2 to 3 amperes per square decimetre of the cathode. Alcohol may be obtained directly from acetylene by passing it through the cathode chamber provided the electrolyte contains a mercury salt. If the conditions of temperature, current density, or proportion of acid or aldehyde be varied, secondary products are produced by the hydrogenation of the products of condensation of aldehyde; the method of obtaining such secondary products is given. If the diaphragm be omitted or

its efficiency be reduced, ethyl acetate may be produced by the combination of the alcohol formed at the cathode with the acid formed at the anode. Ozonised oxygen is also produced, and may be used in other chemical processes.

140,128. RICH GASES, PROCESS AND APPARATUS FOR THE PRODUCTION OF, BY MEANS OF PETROLEUM RESIDUES. Société de Chimie et Catalyse Industrielles, 3, Rue Vignon, Paris. International Convention date (France), February 20, 1918.

The process is for increasing the calorific and lighting power of blue gas, or poor gas, by adding gas obtained by passing the vapour of petroleum residue through retorts containing catalysers, such as copper or iron filings, the retorts being heated to 500°C.-600°C. The residue is converted into hydrocarbons boiling up to 150°C., which may be used as motor fuel, and gas which is added to the blue gas. The catalyst may be in the form of briquettes, which are placed side by side on a series of channel-iron supports within a retort which is practically filled by the briquettes. The petroleum residues are vaporised in a boiler which is superposed on, and cast in one piece with the retort, and the vapour is passed through the retort and thence to a condenser. The retort is of rectangular section, and the channel-irons are arranged so that the briquettes are easily withdrawn to regenerate them. The apparatus is also applicable for similar treatment of tar, shale, wood or fish oils.

140,266. CLASSIFYING AND CONCENTRATING APPARATUS FOR MINERALS AND THE LIKE. W. W. Richardson, 4, London Wall Buildings, London, E.C.2. Application date, March 17, 1919.

Minerals are classified and concentrated by passing them through a rotating trommel, where they are washed with water. The trommel *a* is built up of a number of sections, and is

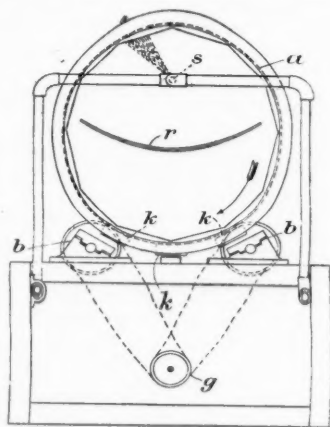


Fig. 1.

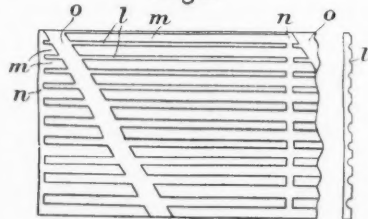


Fig. 2.

Fig. 3.

140,266

arranged to rotate about a horizontal axis by contact with a pair of driving wheels, *b*, carried by shafts *c* extending the whole length of and parallel with the trommel, and driven by chains *h* from the sprocket wheel *g*. The longitudinal axis of the trommel may be inclined to the horizontal by varying the distance between the driving wheels *b* at the discharge end. Axial movement of the trommel is prevented by rollers *k*. The trommel is lined inside with riffle plates, which are shown

separately in an enlarged view below; the plates may be made of non-corrosive steel, cast iron, manganese steel, &c., and are provided along their inner faces with longitudinal channels *l*, arranged so that the width of the ridges *m* between each pair of grooves is greater than the width of the grooves. The grooves gradually increase in width and depth from the forward moving edge of the plates to the following edge, as shown, so that graduated classification of the dirt is obtained. Each plate is also formed with transverse ridges, *n*, and inclined ridges, *o*, to improve the separation of the minerals. Water is supplied through the perforated pipe *s* to wash off the material on the inner surfaces of the riffle plates. The material to be treated is delivered through a shoot into one end of the trommel, and the values are trapped in the grooves *l* of the riffle plates, and are carried round with the trommel until washed off by the jets of water from the pipe *s*. The values fall into the tray *r*, and are carried along to the discharge at the other end of the trommel, while the residue flows along the bottom of the trommel to be carried away to a dump. In a modification the sections of riffle plates are made of gradually increasing diameter towards the discharge end of the trommel. In another modification the trough *r* may be in two parts, inclined downwards towards the opposite ends of the trommel, to separate the coarse and fine particles.

140,297. BARIUM HYDROXIDE FROM BARIUM SULPHIDE, PROCESS FOR PREPARING. E. A. Barnes, Allentown, Pa., U.S.A. Application date, July 18, 1919.

Barium sulphide of a strength of 8° to 10° Bé, and a temperature of 15°-20°C., is agitated and rapidly reduced in temperature to 0°-5°C., so that barium hydroxide crystallises out. Under the conditions stated, the barium hydroxide is not contaminated with barium sulphide. The crystals are dried *in vacuo*, or in an atmosphere free from carbon dioxide. The crystals may be washed with saturated barium hydroxide solution to free them from traces of sulphhydrate. The barium hydroxide is thus obtained pure, and may be used for preparing pure barium peroxide.

140,331. CYANAMIDE, PROCESS FOR GRANULATING. L. L. J. Barbé, 120, Grande rue à Saint Maurice, Seine, France. International Convention date (France), March 21, 1919.

Coarsely divided cyanamide is reduced to pieces about the size of an egg in a crusher, and then decarburised by placing in or spraying with water. The pieces of cyanamide are then granulated in a crusher, and the grains are rolled into powdered cyanamide in a suitable machine. The quantity of water used should be such that decarburisation is ensured and some hydrate of lime formed. The final mixture is classified for agricultural purposes.

NOTE.—Specification 134,214, which is now accepted and published, was abstracted when it became open to inspection under the International Convention; it relates to a process of making sodium sulphate. (See THE CHEMICAL AGE, Vol. II., page 23.)

International Specifications Not yet Accepted

138,622. TIN, RECOVERING. T. A. Eklund, 7, Drottningholmssvagen, Stockholm. International Convention date, February 1, 1919.

Waste products containing sulphide, oxide, or oxychloride of tin are dissolved in hot hydrochloric acid with the addition of an oxidising agent, such as nitre or chlorine. The solution is then treated with waste tin plate or other material containing metallic tin to reduce it to stannous chloride, which is then electrolysed. The electromotive force should vary between 0.5 and 2 volts, and the electrolysis is interrupted when it reaches 2 volts. The cathode consists of sheet iron or tin, and the anode consists of carbon, scrap tin, or iron-tin alloy. The solution remaining after the electrolysis may be mixed with an oxidising agent as above, and used for dissolving a fresh quantity of waste material, so that the process is cyclic.

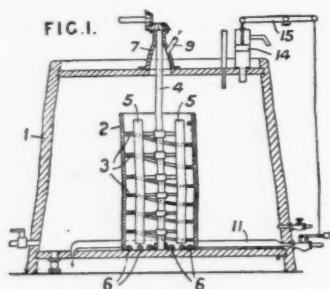
138,649. OXYGEN AND ALKALI PEROXIDES. Ges. für Verwertung Chemischer Produkte, 11, Ehrenbergstrasse, Berlin. (Assignees of C. Clemente, 14, Belle-Alliance-Platz, Berlin.) International Convention date, June 22, 1916.

Carbon dioxide may be absorbed from air and oxygen liberated by means of an alkali peroxide mixed with sodium

sulphate or carbonate crystals or sodium peroxide hydrate $\text{Na}_2\text{O}_2 \cdot 2\text{H}_2\text{O}$. The material mixed with the peroxide should contain water of crystallisation in such quantity as to give half a molecule of water for each molecule of peroxide. The reaction occurring when this mixture is heated probably results in the production of a lower hydrate of the form $\text{Na}_2\text{O}_2 \cdot \text{H}_2\text{O}$. The resulting porous material may be mixed with a catalyst, such as oxide or hydrate of copper, manganese, nickel, cobalt, silver, cerium, uranium, tungsten, molybdenum, vanadium, chromium, thallium, alkalis, alkaline earths or metal powders.

138,650. SAPONIFYING FATS. A. Godal, Vestre Aker, near Christiana. International Convention date. April 29, 1918.

A mixture of fatty acid, such as oleic acid, and aromatic substance, such as naphthalene, is dissolved in benzene and treated with sulphuric acid below 5°C . to produce a sulpho-aromatic fatty acid reagent for saponifying fats. Aromatic sulphonic acid is removed by washing with dilute sulphuric acid, and the reagent is then dissolved, out with water from the residue of unchanged materials, which are then used over again, and the solution of reagent is concentrated *in vacuo*. The fat to be saponified is heated to 100°C . in a wooden vessel 1 out of contact with air, by means of steam injected into it, and the temperature is maintained by means of a steam coil, 11. The supply of steam to the coil is regulated by means of a



138,650

thermostat, 14, actuated by the expansion of the liquid, and controlling the steam valve through a lever, 15. The liquid is agitated by means of paddle blades 5 mounted on a vertical shaft, 4, and rotating in a cylinder, 2, which is provided with internal helical ribs, 3. The cylinder communicates with the vessel through openings 6 at the bottom. The process is stopped when about 80 per cent. of the charge is decomposed, the liquid is allowed to stand, and the glycerine water is run off. Water is then added and the treatment continued until only 2 to 5 per cent. of the charge remains undecomposed, when the liquor is again run off. Barium or calcium carbonate is added to the first water to precipitate the reagent as a salt, which is converted into the free acid by adding sulphuric acid. The second water may be used for mixing with a fresh charge of material.

LATEST NOTIFICATIONS

- 141,333. Side-chain oxidation. Commercial Research Co. April 7, 1919.
- 141,341. Oil-containing vegetable materials, treatment of. K. Erslev. April 9, 1919.
- 141,351. Abrasive and refractory material, Process for the manufacture of. E. Assie. August 9, 1917.
- 141,352. Electric furnaces. E. Assie. August 9, 1917.
- 141,361. Acrolein, Process for the stabilisation of. C. Moureu, C. Dufraisse, P. Robin and J. Pougnet. April 8, 1919.
- 141,374. Causing gases and liquids to react with one another, Process and apparatus for. H. Frischer and M. Dracs. October 29, 1917.

Specifications Accepted, with Date of Application

- 122,172. Alkaline Monochromates, Process for transforming into bichromates. Soc. Industrielle de Produits Chimiques. December 25, 1918.
- 123,752. Solvents, Apparatus for use in recovering. E. I. Du Pont de Nemours & Co. January 19, 1918.
- 130,966. Sulphuric acid containing nitrogen oxides. Norsk Hydro-Elektrisk Kvaestofaktieselskab. August 9, 1918.

- 131,283. Hyosciamine, Process for the isolation of. Chemische Fabrik vorm. Sandoz. August 15, 1918.
- 140,478. Glyoxal, Process for the preparation of. E. C. R. Marks. (A. Bosshard.) October 11, 1917.
- 140,484. Cyanogen compounds or cyanide, Processes and apparatus for the production of. G. Calvert, October 21, 1918.
- 140,505. Ammonia, Process of recovery of. W. J. Chrystal. December 3, 1918.
- 140,513. Oil-extraction apparatus. H. Engel. December 20, 1918.
- 140,563. Electrolytic cell. J. Harris. February 21, 1919.
- 140,635. Tubular heating appliances of vacuum pans and other liquid heating apparatus. Fawcett, Preston & Co. and H. W. Taylor. May 3, 1919.
- 140,694. Pyrogallie acid, Process for the preparation of. E. C. R. Marks. (Nitritfabrik Akt.-Ges.) August 29, 1919.
- 140,715. Filter presses. P. W. Norman and Aluminium Plant & Vessel Co. October 27, 1919.

Transactions in Soda Ash

At the Liverpool County Court on Monday, W. P. England & Co., drysalts, of Huddersfield, claimed damages from H. A. Walker & Co., drysalts, of Exchange Street East, Liverpool, for breach of a contract arising out of the sale of soda ash by the plaintiffs to the defendants in April of last year.

Mr. Wilmshurst, of Huddersfield, who appeared for the plaintiffs, said one of his conditions of the contract for sale was that the soda ash was for consumption in Yorkshire, this being one of the conditions imposed by the United Alkali Co., from which the plaintiffs, as middlemen, bought the material. It was alleged that the defendants committed a breach by exporting the soda ash overseas, and when it became known that there was some difficulty about another consignment, owing to the lack of shipping, it came to the ears of the United Alkali Co. that a previous consignment had been dealt with, contrary to the conditions under which it was sold, with the result that the United Alkali Co., of whom the plaintiffs had been customers for many years, refused to supply them with a further consignment which they had on order for the defendants on similar terms. Mr. Wilmshurst said his clients were not out so much for damages as for rehabilitating themselves in the eyes of the United Alkali Co.

Evidence on behalf of the plaintiffs having been given, Mr. J. H. Layton, who appeared for the defendants, admitted that there had been a breach in regard to the first consignment in the way complained of, but submitted that there was no evidence of any damage. He contended that the admitted breach had not led to the second contract being cancelled, and even if it had the United Alkali Co. were not justified in refusing delivery to the plaintiffs, who could claim damages against the United Alkali Co. if they so wished.

His Honour Judge Thomas held that the plaintiffs were not parties to the breach of the conditions of the contract that the goods were for consumption in Yorkshire. He did not think, however, that the plaintiffs were entitled to any special damage as claimed, or loss of profit, but he thought they were entitled to nominal damages for the breach of contract which was admitted, and these he assessed at £1.

DR. PHILIP SHIDROWITZ reviews in the *Times Trade Supplement* this week the position with regard to the production of power alcohol on a sufficient scale to relieve the situation that is likely to arise from the shortage of petrol forecasted by the Motor Fuel Committee. The effect of the existing statutory restrictions and the prohibitive excise duties levied is also discussed.

In the course of the discussion in the House of Commons on the MINISTRY OF MUNITIONS VOTE, last week, Mr. James Hope referred to the large stocks of chemicals accumulated at the time of the Armistice and explained that the Government policy had been to unload these stocks through trade channels in moderate quantities and to follow very steady the market price in each case. The amount received from the sale of chemicals was £24,000,000 and that by no means completed the sales.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co. and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The weekly report contains only commodities whose values are at the time of particular interest or of a fluctuating nature. A more complete report and list are published once a month. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.

Market Report

THURSDAY, April 22.

The volume of business passing has been somewhat less than before the holidays, but the demand is slightly recovering, and during the last two days has been much more active. In spite of the small inquiry, values show little or no depreciation, and generally speaking there is still an upward tendency, although not to the same extent as has been experienced lately. It is difficult at the present time to see how values can decline to any extent, much as this would be welcomed, and on any greatly renewed activity in buying we are of opinion that prices will very quickly respond, as stocks are extremely light, and makers in the main are fully sold for a considerable time ahead.

EXPORT BUSINESS.—As regards the continent this is very restricted, owing to the low value of the French and Italian currency. As the Continental manufacturers almost invariably advance their price consistent with the depreciation in exchange, the value of the small imports is not adversely affected. On the other hand, the demand from the far East and South America continues unabated and some heavy business has been offered for this market.

General Chemicals

ACETONE remains a strong market, and it is not thought that prices have reached the top. There is a considerable inquiry and good business is passing.

ACID ACETIC is in better demand at higher values. Spot parcels are easily snapped up and much more business has been placed for forward delivery.

ACID FORMIC is inclined to be scarce, but there is no change in value.

ACID LACTIC has been quiet, but there is no change in price to report.

ACID OXALIC.—Only small parcels appear on the market from time to time, and these are readily absorbed at full figures.

ACID TARTARIC is as firm as ever, and any available supplies are quickly absorbed.

AMMONIUM SALTS are in good demand and extremely firm. Makers are on the whole reluctant sellers.

ARSENIC has been a quiet market, without any change to report.

BARIUM SALTS are all in good request, and Chloride is again higher in price.

COPPER SULPHATE is a slow market, and is inclined to be easier.

FORMALDEHYDE.—The spot price is firmly maintained, and little relief is indicated, even in regard to parcels for forward delivery.

IRON SULPHATE (GREEN COPPERAS) remains a firm and active market.

LEAD SALTS.—Inquiries on home trade account have not been so active, but a good business has been transacted on export account. Values are unchanged.

POTASSIUM PERMANGANATE is in good demand and difficult to obtain for early delivery. Price is well maintained.

POTASSIUM PRUSSATE is in good inquiry and has a distinctly firmer tendency and very few Continental supplies are now reaching this country.

SODIUM ACETATE is dearer and scarcer, particularly for early arrival.

SODIUM BICHROMATE.—Only second-hand parcels are available and command a high premium.

SODIUM CAUSTIC.—The position is a shade easier, due no doubt to the slackening in demand, consequent upon the depreciation in the Continental exchange. In our view, however, this is only temporary and the demand is certain to resume immediately the present conditions have adjusted themselves somewhat.

SODIUM HYPOSULPHITE is almost unobtainable, and there is a sharp advance.

SODIUM NITRITE is in good demand, and imports are quite inadequate.

SODIUM PRUSSATE is a shade easier, but a fair business appears to have been transacted.

SODIUM SULPHIDE is quite nominal and supplies are practically unobtainable.

TIN SALTS are on the easy side, with little business passing.

Coal Tar Intermediates

There is little change to report in this market. English makers are only delivering slowly, while arrivals from America are light. Export licences are practically unobtainable in most cases.

ANILINE OIL and SALT are in request for export, but it is practically impossible to obtain licences.

ALPHA NAPHTHYLAMINE is in short supply and very firm in price.

BETA NAPHTHOL is without change in price for forward delivery. Makers are extremely reluctant to accept further commitments in view of the uncertain conditions ahead.

DIMETHYLANILINE is in request, but supplies are practically unobtainable.

DINITROCHLOROBENZOL has been in request on export account.

PARAPHENYLENE DIAMINE.—The demand has been more active, but the supplies available are very light.

PARANITRANILINE has shown a tendency to still further advance, but it is now practically impossible to purchase for delivery except for many months ahead.

RESORCIN appears on the market sparingly, and the supply is nothing like equal to the demand.

SALICYLIC ACID.—A good trade has been passing, without change in value.

Coal Tar Products

There is little change to report since last week.

90's BENZOL is now worth 2s. 6d. on rails.

CREOSOTE OIL remains firm at 1s. 1d. in the North, and 1s. 2d. to 1s. 2½d. in the South.

SOLVENT NAPHTHA is worth 2s. 9d. to 3s. per gallon.

HEAVY NAPHTHA is worth 3s. 3d. to 3s. 6d. per gallon.

NAPHTHALENE.—Although export has been restricted, the price remains firm. Crude is worth £14 to £18 per ton, and refined from £34 to £38.

PITCH.—The market is steady and nominally unchanged, but very little interest is taken in business for near deliveries.

Sulphate of Ammonia

The position is unchanged and the most interesting question of the moment is whether the Government control will be continued after the 31st May.

Current Prices

Chemicals

	per	£	s	d.	to	£	s	d.
Acetic anhydride	lb.	0	3	6	to	0	3	9
Acetone oil	ton	85	0	0	to	90	0	0
Acetone, pure	ton	115	0	0	to	120	0	0
Acid, Acetic, glacial, 99-100%	ton	120	0	0	to	122	10	0
Acetic, 80% pure	ton	95	0	0	to	97	10	0
Arsenic	ton	100	0	0	to	105	0	0
Boric, cryst.	ton	74	10	0	to	76	0	0
Carbolic, cryst. 39-40%	lb.	0	1	4	to	0	1	5
Citric	lb.	0	7	0	to	0	7	3
Formic, 80%	ton	115	0	0	to	120	0	0
Gallic, pure	lb.	0	7	3	to	0	7	9
Hydrofluoric	lb.	0	0	7	to	0	0	8
Lactic, 50 vol.	ton	65	0	0	to	70	0	0
Lactic, 60 vol.	ton	80	0	0	to	85	0	0
Nitric, 80 Tw.	ton	40	0	0	to	42	0	0

	per	£	s.	d.		£	s.	d.		per	£	s.	d.		£	s.	d.
Acid, Oxalic	lb.	0	3	0	to	—	—	—	Sodium Hydrosulphite, powder, 85%	lb.	0	3	3	to	0	3	6
Phosphoric, 1.5	ton	60	0	0	to	65	0	0	Hyposulphite, commercial	ton	30	0	0	to	32	10	0
Pyrogallie, cryst	lb.	0	11	6	to	0	11	9	Nitrite, 96-98%	ton	120	0	0	to	125	0	0
Salicylic, Technical	lb.	0	3	0	to	0	3	3	Phosphate, crystal	ton	40	0	0	to	42	0	0
Salicylic, B.P.	lb.	0	3	9	to	0	4	0	Perborate	lb.	0	2	2	to	0	2	4
Sulphuric, 92-93%	ton	7	15	0	to	8	5	0	Prussiate	lb.	0	1	11	to	0	1	11½
Tannic, commercial	lb.	0	5	0	to	0	5	3	Sulphide, crystals	ton	28	0	0	to	30	0	0
Tartaric	lb.	0	4	1	to	0	4	2	Sulphide, solid, 60-62%	ton	51	0	0	to	52	0	0
Alum, lump	ton	19	10	0	to	20	0	0	Sulphite, cryst.	ton	14	10	0	to	15	10	0
Alum, chrome	ton	93	0	0	to	95	0	0	Strontium, carbonate	ton	85	0	0	to	90	0	0
Alumino ferric	ton	9	0	0	to	9	10	0	Nitrate	ton	85	0	0	to	90	0	0
Aluminium, sulphate, 14-15%	ton	17	10	0	to	18	10	0	Sulphate, white	ton	8	10	0	to	10	0	0
Aluminium, sulphate, 17-18%	ton	20	10	0	to	21	10	0	Sulphur chloride	ton	42	0	0	to	44	10	0
Ammonia, anhydrous	lb.	0	1	9	to	0	2	0	Sulphur, Flowers	ton	25	0	0	to	27	0	0
Ammonia, .880	ton	32	10	0	to	37	10	0	Roll	ton	24	0	0	to	26	0	0
Ammonia, .920	ton	20	0	0	to	24	0	0	Tartar emetic	lb.	0	3	5	to	0	3	6
Ammonia, carbonate	lb.	0	0	7½	to	—	—	—	Tin perchloride, 33%	lb.	0	2	6	to	0	2	7
Ammonia, chloride	ton	95	0	0	to	97	10	0	Perchloride, solid	lb.	0	3	0	to	0	3	3
Ammonia, muriate (galvanisers) ..	ton	52	0	0	to	54	0	0	Protochloride (tin crystals)	lb.	0	1	11	to	0	2	0
Ammonia, nitrate	ton	60	0	0	to	65	0	0	Zinc chloride, 102 Tw.	ton	22	0	0	to	23	10	0
Ammonia, phosphate	ton	135	0	0	to	140	0	0	Chloride, solid, 96-98%	ton	60	0	0	to	65	0	0
Ammonia, sulphocyanide	lb.	0	2	3	to	0	2	6	Oxide, 99%	ton	82	10	0	to	85	0	0
Amyl, acetate	ton	360	0	0	to	370	0	0	Oxide, 94-95%	ton	70	0	0	to	72	10	0
Arsenic, white, powdered	ton	70	0	0	to	72	0	0	Dust, 90%	ton	90	0	0	to	92	10	0
Barium, carbonate	ton	13	10	0	to	14	10	0	Sulphate	ton	19	10	0	to	23	10	0
Barium, carbonate, 92-94%	ton	14	10	0	to	15	0	0									
Chlorate	lb.	0	1	4	to	0	1	5									
Chloride	ton	35	0	0	to	36	0	0									
Barium, Nitrate	ton	50	0	0	to	51	0	0									
Sulphate, blanc fixe, dry	ton	25	10	0	to	26	0	0									
Sulphate, blanc fixe, pulp	ton	15	10	0	to	16	0	0									
Bleaching powder, 35-37%	ton	18	10	0	to	19	10	0									
Borax crystals	ton	41	0	0	to	42	10	0									
Calcium acetate, Brown	ton	20	0	0	to	21	0	0									
Grey	ton	41	0	0	to	42	10	0									
Carbide	ton	30	0	0	to	32	0	0									
Chloride	ton	9	10	0	to	10	10	0									
Carbon bisulphide	ton	58	0	0	to	59	0	0									
Casein, technical	ton	80	0	0	to	83	0	0									
Cerium oxalate	lb.	0	3	9	to	0	4	0									
Chromium acetate	lb.	0	1	2	to	0	1	4									
Cobalt acetate	lb.	0	7	0	to	0	7	6									
Oxide, black	lb.	0	7	9	to	0	8	0									
Copper chloride	lb.	0	1	3	to	0	1	6									
Sulphate	ton	46	0	0	to	47	0	0									
Cream Tartar, 98-100%	ton	310	0	0	to	315	0	0									
Epsom salts (see Magnesium sulphate)																	
Formaldehyde 40% vol.	ton	355	0	0	to	360	0	0									
Formosul (Rongalite)	lb.	0	4	0	to	0	4	3									
Glauber salts	ton	5	0	0	to	5	10	0									
Glycerine, crude	ton	70	0	0	to	72	10	0									
Hydrogen peroxide, 12 vols.	gal.	0	2	8	to	0	2	9									
Iron perchloride	ton	50	0	0	to	52	0	0									
Iron sulphate (Copperas)	ton	4	15	0	to	5	0	0									
Lead acetate, white	ton	100	0	0	to	105	0	0									
Carbonate (White Lead)	ton	75	0	0	to	77	10	0									
Nitrate	ton	75	0	0	to	80	0	0									
Litharge	ton	64	0	0	to	66	0	0									
Lithopone, 30%	ton	60	0	0	to	62	0	0									
Magnesium chloride	ton	15	10	0	to	16	10	0									
Carbonate, light	cwt	2	15	0	to	3	0	0									
Sulphate (Epsom salts commercial)	ton	14	0	0	to	14	10	0									
Sulphate (Druggists')	ton	18	10	0	to	19	10	0									
Manganese, Borate	ton	190	0	0	to	—	—	—									
Sulphate	ton	105	0	0	to	110	0	0									
Methyl acetone	ton	95	0	0	to	100	0	0									
Alcohol, 1% acetone	gall.	Nominal															
Nickel ammonium sulphate, single salt	ton	50	0	0	to	52	10	0									
Potassium bichromate	lb.	0	2	2	to	0	2	3									
Carbonate, 90%	ton	102	0	0	to	105	0	0									
Chloride	ton	Nominal															
Potassium Chlorate	lb.	0	1	0	to	0	1	0½									
Meta-bisulphite, 50-52%	ton	270	0	0	to	280	0	0									
Nitrate, refined	ton	72	0	0	to	75	0	0									
Permanganate	lb.	0	6	6	to	0	6	9									
Prussiate, red	lb.	0	6	3	to	0	6	6									
Prussiate, yellow	lb.	0	2	4	to	0	2	5									
Sulphate, 90%	ton	31	0	0	to	33	0	0									
Salammoniac, firsts	cwt.	4	15	0	to	—	—	—									
Seconds	cwt.	4	10	0	to	—	—	—									
Sodium acetate	ton	65	0	0	to	66	0	0									
Arsenate, 45%	ton	60	0	0	to	62	0	0									
Bicarbonate	ton	10	10	0	to	11	0	0									
Bichromate	lb.	0	2	0	to	0	2	1									
Bisulphite, 60-62%	ton	45	10	0	to	47	10	0									
Chlorate	lb.	0	0	5½	to	0	0	6½									
Caustic, 70%	ton	43	10	0	to	44	10	0									
Caustic, 76%	ton	44	10	0	to	45	10	0									

Sodium Hydrosulphite, powder, 85%	lb.	0	3	3	to	0	3	6
Hyposulphite, commercial	ton	30	0	0	to	32	10	0
Nitrite, 96-98%	ton	120	0	0	to	125	0	0
Phosphate, crystal	ton	40	0	0	to	42	0	0
Perborate	lb.	0	2	2	to	0	2	4
Prussiate	lb.	0	1	11	to	0	1	11½
Sulphide, crystals	ton	28	0	0	to	30	0	0
Sulphide, solid, 60-62%	ton	51	0	0	to	52	0	0
Sulphite, cryst.	ton	14	10	0	to	15	10	0
Strontium, carbonate	ton	85	0	0	to	90	0	0
Nitrate	ton	85	0	0	to	90	0	0
Sulphate, white	ton	8	10	0	to	10	0	0
Sulphur chloride	ton	42	0	0	to	44	10	0
Sulphur, Flowers	ton	25	0	0	to	27	0	0
Roll	ton	24	0	0	to	26	0	0
Tartar emetic	lb.	0	3	5	to	0	3	6
Tin perchloride, 33%	lb.	0	2	6	to	0	2	7
Perchloride, solid	lb.	0	3	0	to	0	3	3
Protochloride (tin crystals)	lb.	0	1	11	to	0	2	0
Zinc chloride, 102 Tw.	ton	22	0	0	to	23	10	0
Chloride, solid, 96-98%	ton	60	0	0	to	65	0	0
Oxide, 99%	ton	82	10	0	to	85	0	0
Oxide, 94-95%	ton	70	0	0	to	72	10	0
Dust, 90%	ton	90	0	0	to	92	10	0
Sulphate	ton	19	10	0	to	23	10	0

Coal Tar Intermediates, &c.

	per	£	s.	d.		£	s.	d.
Alphanaphthol, crude	lb.	0	4	0	to	0	4	3
Alphanaphthol, refined	lb.	0	5	0	to	0	5	3
Alphanaphthylamine	lb.	0	3	6	to	0	3	9
Aniline oil, drums extra	lb.	0	1	5	to	0	1	6
Aniline salts	lb.	0	1	10	to	0	2	0
Anthracene, 85-90%	lb.	—	—	—	to	—	—	—
Benzaldehyde (free of chlorine)	lb.	0	5	6	to	0	6	0
Benzidine, base	lb.	0	12	6	to	0	13	6
Benzidine, sulphate	lb.	0	10	0	to	0	11	0
Benzoic acid	lb.	0	5	6	to	0	6	0
Benzoate of soda	lb.	0	5	6	to	0	6	0
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3
Betanaphthol benzoate	lb.	1	6	0	to	1	7	6
Betanaphthol	lb.	0	5	0	to	0	5	3
Betanaphthylamine, technical	lb.	0	8	6	to	0	9	6
Croceine Acid, 100% basis	lb.	0	5	0	to	0	6	3
Dichlorobenzol	lb.	0	0	6	to	0	0	7
Diethylaniline	lb.	0	7	9	to	0		

Coal Tar Intermediates, &c.

	per	£	s.	d.		£	s.	d.
Alphanaphthol, crude	lb.	0	4	0	to	0	4	3
Alphanaphthol, refined	lb.	0	5	0	to	0	5	3
Alphanaphthylamine	lb.	0	3	6	to	0	3	9
Aniline oil, drums extra	lb.	0	1	5	to	0	1	6
Aniline salts	lb.	0	1	10	to	0	2	0
Anthracene, 85-90%	lb.	—	—	—	to	—	—	—
Benzaldehyde (free of chlorine)....	lb.	0	5	6	to	0	6	0
Benzidine, base	lb.	0	12	6	to	0	13	6
Benzidine, sulphate	lb.	0	10	0	to	0	11	0
Benzoic acid	lb.	0	5	6	to	0	6	0
Benzoate of soda	lb.	0	5	6	to	0	6	0
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3
Betanaphthol benzoate.....	lb.	1	6	0	to	1	7	6
Betanaphthol	lb.	0	5	0	to	0	5	3
Betanaphthylamine, technical.....	lb.	0	8	6	to	0	9	6
Croceine Acid, 100% basis	lb.	0	5	0	to	0	6	3
Dichlorobenzol	lb.	0	0	6	to	0	0	7
Diethylaniline	lb.	0	7	9	to	0	8	6
Dinitrobenzol	lb.	0	1	5	to	0	1	6
Dinitrochlorobenzol	lb.	0	1	5	to	0	1	6
Dinitronaphthaline	lb.	0	1	4	to	0	1	6
Dinitrotoluenol	lb.	0	1	8	to	0	1	9
Dinitrophenol	lb.	0	3	6	to	0	3	9
Dimethylaniline	lb.	0	4	9	to	0	5	0
Diphenylamine	lb.	0	4	9	to	0	5	0
H-Acid	lb.	0	13	6	to	0	14	0
Metaphenylenediamine	lb.	0	5	9	to	0	6	0
Monochlorobenzol	lb.	0	0	10	to	0	1	0
Metanilic Acid	lb.	0	7	6	to	0	8	6
Monosulphonic Acid (2:7)	lb.	0	7	6	to	0	8	0
Naphthionic acid, crude	lb.	0	5	6	to	0	6	0
Naphthionate of Soda	lb.	0	6	0	to	0	6	6
Naphthylamine-di-sulphonic-acid...	lb.	0	5	6	to	0	6	6
Nitronaphthaline	lb.	0	1	3	to	0	1	4
Nitrotoluenol	lb.	0	1	4	to	0	1	6
Orthoamidophenol, base.....	lb.	0	18	0	to	1	0	0
Orthodichlorobenzol	lb.	0	1	2	to	0	1	4
Orthotoluidine	lb.	0	2	6	to	0	2	9
Orthonitrotoluenol	lb.	0	1	8	to	0	1	10
Para-amidophenol, base	lb.	0	15	0	to	0	16	0
Para-amidophenol, hydrochlor	lb.	0	15	6	to	0	16	0
Paradichlorobenzol	lb.	0	0	6	to	0	0	8
Paranitraniline	lb.	0	8	0	to	0	8	6
Paranitrophenol	lb.	0	2	6	to	0	2	9
Paranitrotoluenol	lb.	0	5	3	to	0	5	6
Paraphenylenediamine, distilled ...	lb.	0	13	6	to	0	14	6
Paratoluidine	lb.	0	7	6	to	0	8	6
Phthalic anhydride	lb.	0	5	6	to	0	6	0
R. Salt, 100% basis	lb.	0	4	0	to	0	4	2
Resorcin, technical	lb.	0	11	6	to	0	12	6
Resorcin, pure	lb.	0	17	6	to	1	0	0
Salol	lb.	0	5	9	to	0	6	0
Shaeffer acid, 100% basis.....	lb.	0	3	6	to	0	3	0
Sulphanilic acid, crude	lb.	0	1	5	to	0	1	6
Tolidine, base	lb.	0	10	6	to	0	11	6
Tolidine, mixture	lb.	0	3	0	to	0	3	3

Chemical Co.'s Action Against Gas Co.

MR. JUSTICE SHEARMAN, sitting in the King's Bench Division on Monday, commenced the hearing of an action by J. M. Steel & Co., Thames House, Green Street Place, London, chemical merchants, against the Gas, Light & Coke Co., with reference to certain transactions in naphthaline.

It was stated that before the war the plaintiffs had bought their supplies from the defendants, but owing to the war supplies were depleted and the plaintiffs had been compelled to go into the market and purchase from people who had bought from the defendants. One of these people was a Mr. McCarthy, who was the acting agent, as an employee of the Williams Drug Co., of Bombay. On March 8, 1916, the plaintiffs bought from him 10 tons of ball naphthaline at £46 10s. per ton, and on March 10 paid him £465 and obtained a delivery order on the Gas Co. On April 12 the plaintiffs asked the defendants to prepare the goods for delivery. When the plaintiffs' agent's van went for the goods, the defendants said they could not deliver until the plaintiffs paid for the goods. Thereupon the plaintiffs, in error, paid the defendants the money they demanded—£425. The plaintiffs had therefore paid McCarthy £465 and the defendants £425. Two years later the plaintiffs found the mistake out and now asked for the return of the £425. The second transaction was on July 29, 1916, when the plaintiffs bought a further 10 tons of this stuff from McCarthy at £47 per ton. On August 4, 1916, McCarthy paid for the goods—£450—and gave the plaintiffs a delivery order on the defendants and instructed the defendants to deliver the goods to the plaintiffs. On the same day the plaintiffs made an inquiry of the defendants as to whether the goods had been paid for by McCarthy and they said they had. The plaintiffs thereupon paid McCarthy £475, their contract price for the 10 tons. At the time Messrs. Steel were in difficulties owing to the amount of stuff they had awaiting shipment and did not take delivery immediately. They subsequently requested delivery, but the defendants failed to deliver. The plaintiffs therefore also sought to recover this money paid in respect of the second transaction, for a consideration which had wholly failed or damages for alleged breach of contract.

Evidence was given for the defendants by Mr. Oliver, their sales manager, who said he had charge of these particular purchases made by McCarthy from the defendant company.

Giving judgment, his Lordship said plaintiffs failed in the first claim and succeeded in the other. As to the first, the defendants had not been overpaid, and they had not got any money in their hands which, according to equity, ought to be repaid to plaintiffs. He was unable to hold that this was plaintiffs' money held by defendants for plaintiffs' use, or that defendants had done anything that amounted to a recognition of plaintiffs' title.

On the second claim, his Lordship said the defendants had £450 which was really the money of the plaintiffs, and it was their duty to return it to the plaintiffs. There would be judgment for the plaintiffs for £450, with the general costs of the action, the defendants to have the costs of the issue on which they had succeeded.

Future of Billingham Factory

Contract Arranged with British Syndicate

The *Times* announces what has been well known for some time, though no official statement has yet been made on the subject—namely, that a contract has been arranged whereby a syndicate comprising Messrs. Brunner, Mond & Co., Ltd., and Explosives Trades, Ltd., purchases the extensive site at Billingham-on-Tees, in county Durham, which the Government acquired more than two years ago for the purpose of building a nitrogen factory thereon. Little was done on the site beyond the erection of a few stores and the laying out of a road, but a considerable amount of material was ordered, and the syndicate takes over all of this that can be utilised. Meanwhile, to save time, it has for some months had a special staff of chemists and engineers engaged in designing the proposed plant and in working out the problems involved in its construction. The scale on which operations are intended may be judged from the fact that the capital required will be probably something like £5,000,000.

Company News

NITRATE RAILWAYS.—No dividend has been declared in respect of the year 1919. For 1918 5 per cent. was paid.

ANGLO-CHILIAN NITRATE & RAILWAY CO.—Dividend of 15s. per preference share and 15s. per ordinary share, being 15 per cent. (free of income tax) on each class of share for year 1919 (same as for 1918).

ANGLO-CONTINENTAL GUANO WORKS.—A final dividend has been declared on the ordinary shares of 1½d. per share, making with the interim dividend paid in September last 12½ per cent. for the year ended December 31.

FORTUNA NITRATE CO.—In conformity with the agreement for sale approved by the shareholders, the properties of this company in Chile have now been transferred to the purchasers. The distribution of the purchase price (£2. 10s. per share) will be made after the passing of the resolutions for placing the company in voluntary liquidation.

UNITED PREMIER OIL & CAKE.—The directors recommend a final dividend of 5 per cent., free of tax, on the ordinary shares, making 10 per cent. for the period ended Dec. 31 last. They have decided to offer the 250,000 unissued ordinary shares at 25s. per share to the holders of the existing ordinary shares in proportion of one new for every two shares held.

BEDE METAL & CHEMICAL.—The profits for the year 1919, after allowing for management expenses and including interest on investments, amount to £35,012 and £1,448 was brought in, making £36,460. The directors have placed to reserve £15,000, to depreciation of Hebburn works £5,000, and of Killingdal mine £2,000, and recommended a dividend of 10 per cent., less tax, for the year, carrying forward, subject to director's fees, £3,004.

SHELL TRANSPORT AND TRADING.—It is announced that the company have decided to increase their ordinary capital, and to make another issue of shares to their shareholders. The issue will be made next July, and the new shares will be allotted in the proportion of one for every two now held, the issue being made at par. Thus the number of ordinary shares of the company will be increased from 20,000,000 to 30,000,000. Last July a similar issue of new shares was made in the same proportion.

ENGLISH OILFIELDS, LTD.—The attention of the directors has been directed to a circular issued to their shareholders by a company called the King's Lynn Petroleum Co., Ltd. From the circular it might be inferred that English Oilfields, Ltd., had some connection with the new company. The directors, however, desire to state that English Oilfields, Ltd., has no connection whatever with the King's Lynn Petroleum Co., Ltd. Dr. Forbes Leslie, the consulting geological expert of English Oilfields, Ltd., also wishes it to be stated that he has had nothing to do with the new venture, that he is not the technical adviser of King's Lynn Petroleum Co., Ltd., and that it is untrue that the property to be taken over by it has been secured on his recommendation, confidential or otherwise.

ASSOCIATED PORTLAND CEMENT.—Presiding at the twenty-first ordinary general meeting of the Associated Portland Cement Manufacturers in London, on Monday, Brigadier-General Stanley drew attention to the Cement Marketing Co., the formation of which, he said, was a corollary to the closer fusion of the Associated & British Companies, and the establishment of a scheme of complete joint management. The Cement Marketing Co. was a joint selling and distributing organisation, embracing several of the allied companies, including Martin Earle & Co., Ltd., and the Wouldham Cement Co., Ltd., and would as from the first of the present month undertake the selling and distribution of the cement and other goods manufactured and produced by the companies referred to. It was hoped that the creation of one central control for the requisition of railway trucks, the allocation of motor lorries and vans, the management of the various companies' large fleets of barges and lighters, and the chartering of all vessels would lessen, if not overcome, such defects as could be remedied by them in connection with the distribution of cement, and would enable the company to see that the interests of the various buyers received equitable treatment. This rearrangement of selling methods was entirely a matter of internal organisation, and had no bearing whatever on the question of prices. The directorate and staff of the Cement Marketing Co. would consist of those hitherto handling the output of the companies named, so that a continuity of touch with old customers was guaranteed.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

London Gazette

Application for Debtor's Discharge

INGHAM, THOMAS, Pendre House, Holywell, Flintshire, chemical manufacturer. May 10, 10.30 a.m. The Castle, Chester.

Companies Winding Up Voluntarily

BROUGHTON DYE MANUFACTORY, LTD.—Liquidator, A. Thwaites, C.A. (of Dickinson, Thwaites & Co.), 105, Market Street, Manchester.

DUNMANUS BAY BARYTES CO., LTD. (in voluntary liquidation).—A meeting of creditors was held at 24, Finsbury Square, London, E.C. 2, on April 21 at 2 p.m. Creditors' claims on or before May 31 to J. D. Henderson, care of Dunmanus Bay Barytes Co., Ltd., 24, Finsbury Square, E.C. 2, liquidator.

GENERAL MINING & METALLURGICAL SYNDICATE, LTD. (In voluntary liquidation).—A meeting of creditors will be held at Suffolk House, Laurence Pountney Hill, London, E.C. 4, on Tuesday, April 27, at 11 a.m. Creditors' claims on or before May 11 to J. M. Hamilton, Liquidator.

LYSOL, LTD. (Winding up voluntarily for reconstruction purposes).—Liquidator, A. B. Russell, 11, Ludgate Hill, E.C.

MEXICAN GRAPHITE CO., LTD.—A meeting of creditors will be held at the offices of Orford Patterson & Peet, C.A., 11, Exchange Buildings, Liverpool, on Friday, April 30, at 12 noon. H. A. Patterson, Liquidator.

YORKSHIRE OIL STORAGE CO., LTD. (In voluntary liquidation).—A meeting of creditors will be held at the Company's office, 4, Lloyd's Avenue, London, E.C., at 12 noon, on Monday, May 3. J. W. Barratt, 19A, Coleman Street, E.C. 2, C.A., Liquidator. This notice, is merely formal to comply with the Companies Acts, as all creditors have been or forthwith will be paid in full.

Mortgages and Charges

[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, created after July 1, 1908, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges which would, if created after July 1, 1908, require registration. The following Mortgages and Charges have been so registered. In each case the total debt, as specified, in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced since such date.]

BRITISH DRUG HOUSES, LTD., LONDON, N.—Registered April 8, debenture securing all moneys due or to become due, to Williams Deacons Bank, Ltd.; general charge. *Nil. April 28, 1919.

TAYLOR'S DRUG CO., LTD., LEEDS.—Registered April 10, £450 mortgage, to Miss F. N. Armitage, Park View Crescent, Roundhay; charged on 806 Leeds Road, Bradford. *£99,985. 13s. 5½d. January 12, 1920.

WILLESDEN VARNISH CO., LTD., LONDON, N.W.—Registered April 8, £7,000 debentures; general charge. *Nil. August 12, 1919.

Satisfactions

HAIGH DYEING CO., LTD., MANCHESTER.—Satisfaction registered April 3, £4,000, registered June 27, 1916.

MOLASSINE CO., LTD., EAST GREENWICH.—Satisfactions registered April 12, for £25, part of £50,000, registered September 12, 1912; and for £3,600, part of £15,000, registered October 13, 1914.

TRANSVAAL OIL SHALE SYNDICATE, LTD., LONDON, E.C.—Satisfaction registered April 10, for £5,000, balance of £10,000, registered July 5, 1918.

County Court Judgment

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

BARTON (A. T.) & CO. (CHEMISTS), LTD., 74, Stratford Road, Acton, W., chemists. £15. 17s. 5d. March 9.
POMEROY, FRANCIS T., 5, The Exchange, London Road, Thornton Heath, chemist. £14. 6s. March 4.

New Companies Registered

The following list has been prepared for us by Jordan & Sons, Ltd., company registration agents, 116 and 117, Chancery Lane, London, W.C. :—

ARROW FUEL CO., LTD., Merthyr House, James Street, Cardiff.—Makers of patent fuel (Arrow Brand). Nominal Capital, £200,000 in 200,000 shares of £1 each. Directors :

L. F. Beynon, Belmont, Christchurch, nr. Newport; F. T. Halford; Lt.-Col. J. C. Kirk, Mount Street, St. Albans, Christchurch, nr. Newport; Sir L. W. Llewelyn, K.B.E., Melpas Court, nr. Newport; S. C. Morgan, Wellwood, Lea, Dinas Powis, nr. Cardiff. Qualification of directors, £500. Remuneration of directors, £1,000 to be divided.
CHEMICAL AND TECHNICAL SYNDICATE, LTD., 287, Regent Street, W.1.—Analytical chemists and chemical engineers. Nominal Capital, £7,000 in 7,000 shares of £1 each. Qualification of directors, 1 share.

COLONIAL OIL AND ASPHALT CO., LTD.—Distillers of petroleum and other oils, shale, asphalt, coal and other substances. Nominal Capital, £25,000 in 25,000 shares of £1 each. Directors : J. D. Fletcher, J. Kelly, A. E. B. Ind, Winchester House, E.C. Qualification of directors, £100.

NORTHERN PETROLEUM SYNDICATE, LTD., 1, Lloyd's Avenue, E.C. 3.—To obtain prospecting and mining rights or privileges for petroleum. Nominal Capital, £60,000 in 60,000 shares of £1 each. Directors : To be appointed by subscribers. Qualification of directors, one share. Remuneration of directors : to be voted by Company in General Meeting.

THORNCLIFFE COAL DISTILLATION, LTD., Thorncliffe Coke Ovens, Thorncliffe, Nr. Sheffield.—Distillation of tar and the manufacture of chemicals and explosives, &c. Nominal Capital, £550,000 in 500,000 preference shares of £1 each and 1,000,000 ordinary shares of 1s. each. Minimum Subscription, 7 shares. Directors : W. N. Drew, Raincliffe, Ecclesfield, nr. Sheffield; J. Godber, 14, Broomhall Road, Sheffield; W. A. Bower Almora Hall, Middleton St. George; W. Hay, White House, Chapelton, dr. Sheffield. Qualification of Directors, £20. Remuneration of Directors, £150 each. Chairman, £200.

TREVEDDOE CONSOLS, LTD., Victoria Place, St. Austell, Cornwall.—To carry on the business of tin, copper and china, clay mining, smelting and refining. Nominal Capital, £64,000 in 64,000 shares of £1 each. Directors : H. Nicholls (Senior), Hallaze, St. Austell; H. Nicholls (Junior), Gwarder, St. Austell; W. T. Nicholls, Hallaze, St. Austell. Qualification of Directors, £4. Remuneration of Directors, £90 per cent.

WADE (H. J.) & CO., LTD., 37, Railway Road, Blackburn.—Chemists, druggists and drysalers. Nominal Capital, £8,000 in 4,000 preference shares and 4,000 ordinary shares of £1 each. Directors : H. J. Wade, 70, East Park Road, Blackburn; B. W. McArthur, Bank House, Golborne. Qualification of Directors, £600.

LONDON FINE CHEMICALS, LTD. : The capital of this company should have been given in our issue last week as £6,000, divided into 5,000 preference shares of £1 each and 20,000 ordinary shares of 1s. each.

Benn Brothers Journals

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WAYS AND MEANS.

"Ramblings in Flanders," by the Editor; Sir George Paish on "The Budget"; "Commercial Aspects of Aviation," by Major P. L. Holmes.

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